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The Engineer

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PUBLIC NOTICES

The Director-General, India Store Department, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for :—

SCHEDULE 1.—761 TONS of STEEL FLAT-FOOTED 60 lb. B.S. RAILS.
SCHEDULE 2.—30 TONS of FISH-PLATES for above Rails.
SCHEDULE 3.—105 TONS of BEARING PLATES for above Rails.

Tenders due on the 16th March, 1928.
Forms of Tender obtainable from the above at a fee (which will not be returned) of 5s. for each schedule. 7913

APPOINTMENT VACANT.
SUPERIOR ESTABLISHMENT.

Applications are Invited by the Secretary to the Hon'ble the Agent to the Governor-General in Baluchistan, Public Works Department, for a POST combining the duties of ELECTRICAL, BOILER and FACTORIES INSPECTOR. Applicant must have wide theoretical knowledge of Steam and Electrical Engineering, coupled with considerable experience in both branches; preference will be given to those having in addition some knowledge of hygiene and sanitation; proof of qualifications is required. Pay Rs. 1000-50-1200 with the possibility of permanent employment, non-pensionable; three years' probation, subject to three months' notice on either side, thereafter the appointment may be terminated at twelve months' notice. Travelling and out-station allowances on the usual scales as for a first-class officer; actual expenses incurred in India for joining will be paid.

Applications to the SECRETARY, as above, at Quetta, Baluchistan, India, will be received up to 18th April, 1928, and must state last appointment held. 7858

Assistant Engineers (10) REQUIRED by the GOVERNMENT of NIGERIA for the PUBLIC WORKS DEPARTMENT for two tours of not less than 12 nor more than 18 months' service in the first instance. Subject to satisfactory service the officers appointed will be eligible at the expiration of three years' service for confirmation in the permanent and pensionable establishment. Salary £480, rising to £920 a year. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, preferably between 25 and 35 years of age, must have passed the examination for A.M.I.C.E. or possess a degree in civil engineering recognised by the Institution as exempting from Parts "A" and "B" of the examination. Must have had proper technical training and preferably have had not less than two years' subsequent experience on large Engineering or Municipal Works.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting M/254. 7748

Assistant Engineers Required for the PUBLIC WORKS DEPARTMENT of the FEDERATED MALAY STATES for four years' service, after which, subject to satisfactory service, the officers appointed will be eligible for confirmation in the permanent and pensionable establishment. It is probable that the number of permanent appointments will be sufficient for those officers whose services have been entirely satisfactory, but no guarantee can be given. If at the end of four years' service an officer's services have been entirely satisfactory and he is not offered or declines further employment he will be paid a bonus of 2850 dollars. Salary 400 dollars a month, rising to 800 dollars by annual increments of 25 dollars, plus a temporary non-pensionable allowance of 10 per cent. for bachelors and 20 per cent. for married men. The exchange value of the dollar in sterling is at present fixed by the Government at 2s. 4d., but its purchasing power in Malaya is considerably less than that of 2s. 4d. in the United Kingdom. No income tax at present imposed by the Federated Malay States Government. Free passages provided. Candidates, age 23 to 26, preferably unmarried, must have received a good theoretical training, preferably at a University or College recognised by the Institution of Civil Engineers, and possess a Civil Engineering Degree or obtain such other diploma or distinction in engineering as the Secretary of State may decide in any particular case, or have completed articles with a civil engineer of good standing and have passed the examination for Associate Membership of the Institution of Civil Engineers. In addition candidates must have had at least one year's practical experience of civil engineering under a qualified civil engineer.—Apply at once by letter, giving brief details of qualifications and experience, and stating age and whether married or single, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting clearly at the head of application M/15224. 7762

County of London.
RING CROSS ESTATE, ISLINGTON.

The London County Council invites TENDERS for the CONSTRUCTION of about 322 FEET of a 9in. Diameter STONEWARE PIPE SEWER and the PAVING with 4in. Tarred Slag Macadam and 2in. Artificial Stone Paving of the CARRIAGEWAY and FOOTWAYS respectively of the New Street for the Diversion of Brand-street in the Metropolitan Borough of Islington.

The specification, form of Tender, &c., may be obtained on application to the Chief Engineer of the Council at the Old County Hall, Spring-gardens, S.W. 1, upon payment of the sum of £2 by cheque or draft to the order of the London County Council. This amount will be returnable only if the tenderer shall have sent in a bona fide Tender and shall not have withdrawn the same. Full particulars of the work may be obtained on personal application and the contract documents may be inspected before the payment of the fee.

Correspondence and remittances by post should be addressed to the Chief Engineer at the Old County Hall, Spring-gardens, S.W. 1, or, if personal application is made, applicants should apply in Room 3A at No. 3, Warwick House-street, Cockspur-street, S.W. 1.

The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract, and in "The London County Council Gazette."

No Tender received by the Clerk of the Council at the County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 26th March, 1928, will be considered.

The Council does not bind itself to accept the lowest or any Tender.

MONTAGU H. COX,
7895 Clerk of the London County Council.

PUBLIC NOTICES

Assistant Engineers Required for the RAILWAY DEPARTMENT of NIGERIA for a tour of 12 to 18 months' service, with prospect of extension. Salary £480, rising to £920 a year. Outfit allowance of £60 on first appointment. Free quarters and passages, liberal leave on full salary. Candidates, aged 23 to 35, should either possess an engineering degree of a recognised University or should have passed Sections "A" and "B" of the Associate Membership Examination of the Institution of Civil Engineers. They should also have had 3 or 4 years' regular training as a civil engineer, preferably on railway works.—Apply at once by letter, stating age, particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/15394. 7889

Royal Burgh of Montrose,
COUNTY OF FORFAR.
PARTIAL DEMOLITION AND RECONSTRUCTION OF BRIDGE OVER THE SOUTH ESK.

Montrose Bridge Joint Committee are prepared to receive TENDERS for the PARTIAL DEMOLITION and RECONSTRUCTION in REINFORCED CONCRETE of the MONTROSE BRIDGE over the South Esk, together with the PROVISION of a TEMPORARY BRIDGE.

The existing suspension bridge is to be demolished and replaced by a reinforced concrete cantilever bridge, central span 216ft. and two side spans of 106ft. with cylinder foundations in river.

Drawings and specifications, &c., may be seen on and after Wednesday, 7th March, 1928, at the offices of Burgh Surveyor, Town Hall, Montrose;
The Ministry of Transport, 122, George-street, Edinburgh;
Sir E. Owen Williams, K.B.E., 5, St. George's-road, Westminster, London, S.W. 1.

Documents, including bill of quantities and drawings, may be obtained on and after the same date at the office of the Engineer, Sir E. Owen Williams, K.B.E., 5, St. George's-road, Westminster, S.W. 1, on depositing £5 5s. and undertaking to return all documents and drawings. The deposit will be returned on receipt of a bona fide Tender. Cheques should be made payable to Montrose Bridge Joint Committee.

Sealed Tenders, endorsed "Tender, Montrose Bridge," must be lodged with the undersigned not later than Thursday, 29th March, 1928. The Committee do not bind themselves to accept the lowest or any Tender.

JAMES CUMMING,
Clerk to the Committee.
Town Clerk's Office,
Montrose, Forfarshire,
27th February, 1928. 7859

PUBLIC NOTICES

City of Birmingham Water DEPARTMENT.
CONTRACT 51.

The Water Committee of the Corporation of the City of Birmingham is prepared to receive TENDERS from competent firms for the MANUFACTURE and DELIVERY of about 5000 LINEAL YARDS of 24in. Internal Diameter SOCKET and SPIGOT STEEL PIPES, LINED CENTRIFUGALLY WITH CONCRETE, delivered at various railway goods stations within the City of Birmingham.

Specification and form of Tender may be obtained on and after Friday, 2nd March, 1928, from the Secretary of the Water Department, Council House, Edmund-street, Birmingham, on payment of the sum of One Guinea. The amount deposited will be refunded on receipt of a bona fide Tender.

Sealed Tenders, on the forms provided for the purpose, addressed to "The Secretary, Water Department, Council House, Birmingham," and endorsed "Contract 51," should be delivered at the Secretary's Office on or before 10 a.m. on Monday, 19th March, 1928.

The Water Committee does not bind itself to accept the lowest or any Tender.

F. W. MACAULAY, M. Inst. C.E.,
Chief Engineer.
J. H. BROADLEY, F.C.I.S.,
Secretary.
Water Department,
Council House, Birmingham,
27th February, 1928. 7887

County Borough of Belfast.
SEWAGE SLUDGE STEAMER.

TENDERS are INVITED for BUILDING a SEWAGE SLUDGE STEAMER of, or about, 320 tons capacity.

Form of Tender, together with general conditions, specifications and drawings, can be obtained from Messrs. John H. MacIlwaine and Son, Naval Architects, 8, Corporation-street, Belfast, on payment of a deposit of £10, which will be returned on receipt of a bona fide Tender.

Tenders, endorsed "Tender for Sewage Sludge Steamer," and marked with the name and address of the firm tendering, must be lodged in the office of the undersigned not later than Monday, 19th March, 1928.

An official receipt must be obtained for every Tender delivered by hand. Tenders sent by post must be registered.

Tenders will only be considered from builders who have had former experience of building this type of steamer, and in applying for the specification the name or number of at least one such vessel built by them must be stated.

The lowest or any Tender will not necessarily be accepted.

R. MEYER,
7864 Town Clerk.

PUBLIC NOTICES

City of Birmingham Water DEPARTMENT.
CONTRACT 21.

The Water Committee of the Corporation of the City of Birmingham is prepared to receive TENDERS from competent firms for the MANUFACTURE and DELIVERY of about 10,000 LINEAL YARDS of 62in. Internal Diameter SOCKET and SPIGOT STEEL PIPES, LINED CENTRIFUGALLY WITH CONCRETE, together with the necessary SPECIALS, &c., for portions of the Third Main on the Elan Aqueduct between Knighton and Hagley, the pipes to be delivered at certain specified railway stations.

Specification and form of Tender may be obtained on and after Friday, 2nd March, 1928, from the Secretary of the Water Department, Council House, Edmund-street, Birmingham, on payment of the sum of One Guinea. The amount deposited will be refunded on receipt of a bona fide Tender.

Sealed Tenders, on the forms provided for the purpose, addressed to "The Secretary, Water Department, Council House, Birmingham," and endorsed "Contract 21," should be delivered at the Secretary's Office on or before 10 a.m. on Monday, 19th March, 1928.

The Water Committee does not bind itself to accept the lowest or any Tender.

F. W. MACAULAY, M. Inst. C.E.,
Chief Engineer.
J. H. BROADLEY, F.C.I.S.,
Secretary.
Water Department,
Council House, Birmingham,
27th February, 1928. 7886

South Indian Railway Company, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

1. LOCOMOTIVE BOILERS.
2. STEEL TYRES.
3. ROLLED STEEL DISC WHEELS and AXLES and AXLES.
4. LOW-TENSION CABLES and SWITCHGEAR.
5. CRANK AXLES for LOCOMOTIVE ENGINES.
6. COPPER PLATES.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Locomotive Boilers," or as the case may be, must be left with the undersigned not later than Twelve Noon on Friday, the 23rd March, 1928, in respect of Specifications Nos. 1 and 4, and the 16th March, 1928, in respect of Specifications Nos. 2, 3, 5 and 6.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of £1 for each copy of Specifications Nos. 1, 2 and 3, of 10s. for each copy of Specification No. 4, and 5s. for each copy of Specification Nos. 5 and 6.

Copies of the drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 2, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.
91, Petty France, S.W. 1,
2nd March, 1928. 7918

TO DREDGING CONTRACTORS.
HARBOUR OF WATERFORD.

Waterford Harbour Commissioners.

The Waterford Harbour Commissioners are prepared to receive TENDERS for DEEPENING the BERTH known as the "Grain Berth" and situate on the north side of the River Suir at Waterford.

The area to be deepened is approximately 450ft. long by 75ft. wide, having a surface level of about 22ft. below Low Water Ordinary Spring Tides and is to be deepened to 25ft. below L.W.O.S.T.

The material to be removed is rock.

Copies of the plan, specification and conditions can be obtained on application to the Harbour Engineer, Harbour Office, Waterford, on payment of Five Guineas, which will be returned in case a bona fide Tender is duly made.

Tenders must be addressed to "The Chairman, Waterford Harbour Commissioners, Harbour Office, Waterford," in a sealed cover endorsed "Grain Berth Tender," and must be delivered not later than One o'clock p.m. on Monday, the 19th day of March, 1928.

The lowest or any Tender will not necessarily be accepted.

Dated the 28th day of February, 1928.

AUSTIN A. FARRELL,
Secretary to the Waterford Harbour Commissioners.
Harbour Office, Waterford. 7880

The Henley-on-Thames Water CO., Ltd., REQUIRE the SERVICES of a RESIDENT ENGINEER, to Take Charge of the whole of the Pumping and Filtering Plant, Mains, Reservoirs, &c.

House, fuel, and light found.

Reply by letter, stating age, experience, and salary required, to the

SECRETARY,
66, Greys-road, Henley-on-Thames. P4238

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PUBLIC NOTICES

Administrative County of LONDON.
DIVISIONAL ENGINEER.

The London County Council invites APPLICATIONS from qualified engineers for the POSITION of an ENGINEER-IN-CHARGE of a division of the Department of the Chief Engineer of the Council. The salary is £700 a year, rising by annual increments of £50 to £900 a year, and is subject to temporary additions, the minimum remuneration being at present about £887 and the maximum about £1101. Candidates must possess recognised qualifications as civil engineers and have occupied positions of responsibility in the conduct of work and the supervision and management of staff. The duties will include the survey and inspection of the river embankments in London and such other duties as may be assigned.

Applications must be made on the official form, copies of which (with full particulars) may be obtained by sending a stamped addressed foolscap envelope, marked "Divisional Engineer," to the Clerk of the Council, The County Hall, Westminster Bridge, S.E. 1. Forms must be returned not later than Friday, 16th March, 1928. Canvassing disqualifies.

MONTAGU H. COX,
7845 Clerk of the London County Council.

Corporation of Durban, Natal.
APPOINTMENT OF TRAMWAY MANAGER.

The undersigned beg to inform applicants for the above position that the POST has now been FILLED.

WEBSTER, STEEL & CO.,
36, Leadenhall-street, London, E.C.,
7891 Agents to the Durban Corporation.

Rangoon Development Trust.

The Trust invites APPLICATION for the POST of EXECUTIVE CIVIL ENGINEER on a salary of Rs. 1000 per mensem, rising by annual increments of Rs. 50 per mensem to Rs. 1500, with a motor car allowance of Rs. 150 per mensem.

The engagement in the first instance will be for a period of three years, but it is possible that a permanent appointment may follow.

The applicant must be a British subject, between the age of 30 and 35 years, who has received a good general education, must have passed the examination of the Institution of Civil Engineers, or of the Institution of Municipal and County Engineers, or hold equivalent professional qualifications; must have experience in municipal civil engineering works on a large scale, including survey work, road construction, waterworks, sewage, drainage, steel work, and reinforced concrete; this experience should include the preparation of general drawings and details, specifications and bills of quantities, estimates, and the control of such works during actual construction.

Preference will be given to a candidate with special knowledge of and practical experience in reinforced concrete and also to approved war service.

The Engineer appointed will be provided with a free first-class passage to Rangoon and £10 for expenses on the voyage. Should he, within three months of the termination of this agreement, decide to return to this country, a free return passage will be provided.

Application must be made in writing, should contain the following information and copies of documents:—Full name, address, copy of birth certificate, health, married or unmarried (particulars of family), full statement in chronological order of education from the age of fourteen, training, and experience, with dates, and should be delivered not later than 21st March, 1928, to J. LUMSDEN RAE, Esq., Dartmouth House, 2, Queen Anne's-gate, Westminster, S.W. 1. 7906

FOR SALE, THEODOLITES, DRAWING INSTRUMENTS, SECOND-HAND. CLARKSON'S, 338, High Holborn, W.C. (Opposite Gray's Inn-road).

FOR SALE, LEVELS, DRAWING INSTRUMENTS, SECOND-HAND. CLARKSON'S, 338, High Holborn, W.C. (Opposite Gray's Inn-road). Ex.

PUBLIC NOTICES

Public Works Ministry,
EGYPTIAN GOVERNMENT.
EGYPTIAN IRRIGATION SERVICE, SUDAN.
NOTICE.

TWO ASSISTANT MECHANICAL ENGINEERS, Grade V., are REQUIRED for work with the fleet and workshops of the Egyptian Irrigation Service in the Sudan.

Applicants must fulfil the following conditions:—

1. Must have had sea-going and workshop experience and have knowledge of drawings and preferably experience of the control of coloured labour. Foundry experience an advantage.
2. Age about 30 to 35 years.

Candidates possessing the required qualifications will be granted a salary of £E28 per month inclusive of all allowances. Single quarters are provided at out-station only.

Period of contract in the first place is two years, subject to extension.

An allowance of £E40 will be given to successful candidates for a change of residence from England to Sudan and vice versa.

Application forms obtainable from the CHIEF INSPECTING ENGINEER, Egyptian Government, 41, Tothill-street, London, S.W. 1, should be completed and sent, together with copies (not originals) of three recent testimonials of experience, to that official before 16th March, 1928.

The Chief Inspecting Engineer reserves to himself the right of rejecting any application without giving reasons for so doing. 7857

Southport, Birkdale and West
LANCASHIRE WATER BOARD.
APPOINTMENT OF ASSISTANT ENGINEER.

The Water Board invite APPLICATIONS for the APPOINTMENT of ASSISTANT ENGINEER at a salary of £400 per annum.

Applicants should be between the ages of 28 and 35 years and Associate Members of the Institution of Civil Engineers. They should have had experience of the design and construction of Waterworks (preferably pumping schemes) and general administration of waterworks undertakings. They must also be capable surveyors and good draughtsmen.

The appointment will be made subject to the provisions of the Local Government and other Officers' Superannuation Act, 1922, and the successful candidate will be required to pass a medical examination.

Applications, in candidates' handwriting, stating age, whether married, qualifications, training, details of experience, present and past appointments, and accompanied by copies of three recent testimonials, must be delivered to the undersigned on or before Monday, 19th March, 1928, endorsed "Assistant Engineer."

Canvassing, either directly or indirectly, will be a disqualification.

C. BURTON EDE, M. Inst. C.E.,
Engineer and Manager.
14, Portland-street, Southport,
25th February, 1928. 7871

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, ELECTRICAL ENGINEER with Up-to-date knowledge of the Application of Electrical Driving to Machine Tools.—Address, with full particulars of experience and salary required, 7888, The Engineer Office. 7888 A

APPLICATIONS are INVITED for the POST of MECHANICAL ENGINEERING INSPECTOR. Candidates should be between 28 and 35 years of age and should have had at least five years' experience in a General Engineering Drawing-office.

Applications will be considered only from those who have had a good practical training and first-class experience in general engineering practice.

Apply in first instance by letter, stating age, qualifications, experience, and salary required, to BRUNNER, MOND and CO., Ltd., Northwich. 7868 A

SITUATIONS OPEN

WANTED for India, ENGINEER SALESMAN, conversant with Air Compressing and Pneumatic Plant for Mining and Workshop Use. Age not over 26; must be single.—State fullest details of education, experience, present work and salary to "Z.Y. 256," Deacon's Advertising Agency, Fenchurch-avenue, London. 7892 A

WANTED, GENERAL ESTIMATOR, Accustomed to Medium and Light Engineering Work.—Applicants to write, stating age, experience, and wages required, to G. D. PETERS and CO., Ltd., Windsor Works, Slough. 7861 A

APPLICATIONS are INVITED for the POST of MECHANICAL ENGINEERING PROGRESS CLERK. Candidates should be between 25 and 30 years of age, and preference will be given to applicants having had experience in general engineering practice.

Apply in first instance by letter, stating age, qualifications, experience, and salary required, to BRUNNER, MOND and CO., Limited, Northwich. 7869 A

ASSISTANT COMMERCIAL MANAGER REQUIRED; must have considerable sales experience, able to control staff and have knowledge of costs and accounts. Locality Lancashire.—Address in confidence, with full information, age and salary required, P4239, The Engineer Office. P4239 A

CEYLON FIRM of GENERAL IMPORTERS and ENGINEERS REQUIRE First-class SALESMAN ASSISTANT, to Take Charge of Showrooms. Must be regularly trained in General Hardware, Engineers' Supplies, Tools, Sanitary Goods, Builders' Ironmongery, Motor Cars and Cycles, Machinery and Electrical Supplies.

Age 24/28, single, candidates must already hold similar position and be used to stock cards, stock-taking, indenting and usual publicity. Applicants must be of good general education, able to keep accounts, attend to correspondence, interview, and develop sales.

Apply on foolscap, giving dates and details of schools and night classes attended with schedule of studies and certificates gained, copies of credentials with statement of experience, giving dates, since leaving school, applicants must state definitely that they are single.

Agreement 4 years; salary Rs. 450 to Rs. 600, passage, 6 months' half-pay leave provided further agreement entered into.

Address, 7866, The Engineer Office. 7866 A

ENGINEERING REPRESENTATIVE REQUIRED for London district, with technical and commercial experience in Heating Work and Fan Engineering. Responsible position available for qualified man.—Address, 7912, The Engineer Office. 7912 A

GOOD COMMISSION OFFERED MAN Who Can place Reliable Case-hardening Compound.—Address, 7910, The Engineer Office. 7910 A

LONDON SALES MANAGER WANTED, with Good business experience. Sound knowledge of Workshop Equipment essential. Directorship available good type man. Investment.—Write, Box 882, Sells, Fleet-street, E.C. 4. 7894 A

POWER PLANT SUPERINTENDENT WANTED for Cement Works in India.—Address, stating age and experience, 7917, The Engineer Office. 7917 A

SALES ENGINEER REQUIRED for Firm of Engineers (Mechanical and Chemical) in Manchester. Must be good correspondent, well educated, age between 23 and 35. The position is a progressive one and a good salary will be paid for a really live energetic man who can show results. Applications only invited from first-class men.—Address in confidence, stating full details of experience, age, salary, &c., P4222, The Engineer Office. P4222 A

UNIVERSITY GRADUATE, About 25, with Knowledge of Steam Engineering and Chemistry, REQUIRED by London Firm. Good prospects for suitable man. State age, experience, and salary required.—Address, 7916, The Engineer Office. 7916 A

SITUATIONS OPEN (continued)

WORKS ASSISTANT (Aircraft) WANTED for planning, with experience of Sheet Steel Fittings, Welding, and Press Work. Applications with particulars of experience, age, and salary required.—Write to Box No. 727, W. S. Crawford, Ltd., 233, High Holborn, W.C. 1. 7813 A

WORKS MANAGER for Bridge and Constructional Steel Works. Applicant must have held successfully a similar post, be able to make up estimates and have a thorough knowledge of piecework rates.

Address, stating age, experience, and salary, 7908, The Engineer Office. 7908 A

WANTED, TWO SENIOR DRAUGHTSMEN, with experience in Modern Cement Works and Construction of River Jetties. State age, experience, and salary required.—Address, 7915, The Engineer Office. 7915 A

CONSTRUCTIONAL STEEL WORK DESIGNER REQUIRED for London Consulting Engineer's Office. Must be conversant with requirements of 1909 Building Act. State experience and salary expected.—Address, P4230, The Engineer Office. P4230 A

DRAUGHTSMAN, Mechanical, WANTED (Ex-Service man preferred), for the S.E. London district, preferably with experience in the design of Small Accurate Machinery.

Commencing salary £150 by annual increment of £7 10s. to £175, plus Civil Service bonus. Total earnings at present on the minimum salary £282 18s.

State age, qualifications, and experience.

Address, 7899, The Engineer Office. 7899 A

DRAUGHTSMAN for Machinery Foundations and General Civil Engineering Work REQUIRED IMMEDIATELY for Engineer's Office in Westminster. State experience, age, salary required.—Address, P4240, The Engineer Office. P4240 A

DRAUGHTSMEN REQD. for Railway Carriage Work; knowledge of Steel Cars an advantage.—Address, P4232, The Engineer Office. P4232 A

DRAUGHTSMAN REQUIRED by Engineering Firm in West of England. Must have good knowledge of Pneumatic Conveying and Elevating Plants. State age, experience, and salary required.—Address, 7884, The Engineer Office. 7884 A

DRAUGHTSMAN REQUIRED by Engineering Firm in West of England, with first-class experience in the lay-out of schemes and getting out designs and quantities for estimating. Must have a thorough knowledge of Labour-saving Appliances for the handling of materials, such as Elevators and Conveyors and Machinery required for Docks, Power Stations, and Works Equipment. Originality and initiative essential.—Address, 7885, The Engineer Office. 7885 A

DRAUGHTSMAN, SENIOR, REQUIRED, London, Commercial Vehicle Design.—Address, stating experience, age, salary required, and when disengaged, P4227, The Engineer Office. P4227 A

DRAUGHTSMAN WANTED for Special Machine Tools. Applications only invited from men of first-class ability.—Address, stating experience, 7775, The Engineer Office. 7775 A

ENGINEER DRAUGHTSMAN REQUIRED IMMEDIATELY for London district, preferably B.O.T. Certificate; desirable have good knowledge small Boiler design for marine requirements.—Apply at once by letter, giving particulars of qualifications, salary required, &c., P4233, The Engineer Office. P4233 A

JIG and TOOL DRAUGHTSMAN REQUIRED for Motor Works. State age, experience, and salary required.—Address, 7860, The Engineer Office. 7860 A

For continuation of Small Advertisements see page 3.

Automatic doors ELIMINATE risk of FIRE

In this air cooler the moment the thermometer reaches the danger line the doors open *automatically*. They are operated by solenoids energised on contact with the index thermometer. Action is instantaneous *and has never yet been known to fail.*

No other cooling system has this feature—it was perfected by Premier engineers and is fully protected by patents. It is a definite guarantee that one of your biggest risks of fire will be eliminated.

Other advantages, also belonging only to Premier, are quite as important.

We urge you to send for more details and an interesting booklet.

The Premier Cooler & Engineering Co., Ltd.,
Shalford, Nr. Guildford, Surrey.

PREMIER Closed Circuit Air Cooler

A Seven-Day Journal

United States Shipping.

PUBLIC discussion of the position of the American mercantile marine was begun on Monday of this week at Washington by the Merchant Marine Committee of the House of Representatives. Simultaneously a proposal has been made to Congress that the world's maritime nations should be invited to take part in a conference with the object of reaching an international agreement on shipping. It is argued by those favouring the calling of such a conference that no nation can adopt a merchant marine policy without affecting other nations, and that the adoption of any one of the schemes for subsidising American shipping now before Congress would provoke retaliation and foreign competition capable of annihilating American shipping interests. The representatives of American shipping who have assembled in Washington to lay their views before the Merchant Marine Committee are said to be unanimous in desiring the abolition of the United States Shipping Board and the cessation of the Government's competition with private shipping interests. On the other hand, representatives of the Shipping Board continue to argue that Government-operated or Government-assisted shipping is the only alternative to no ships at all. They are said to intend to ask Congress to authorise the expenditure of £8,000,000 per year for five years for the purpose of constructing twenty new cargo ships each year.

Proposed High-speed Atlantic Liners.

ON Tuesday, February 28th, the committee referred to in the preceding paragraph heard an appeal by the Transoceanic Corporation of the United States for Government assistance in the construction of a fleet of six 35,000-ton high-speed Atlantic liners, which, if built, will, it is proposed, make the crossing in four days from dock to dock. Reference to these proposed vessels has already been made in our columns. Their length has been given as 900ft., with a beam of 90ft. and a displacement of about 35,000 tons. Comfortable provision is to be made, we learn, for 800 passengers, and about 1000 tons of express mail and cargo are to be carried. The firms interested in the scheme are the American Brown-Boveri Electric Corporation and the New York Shipbuilding Company of Camden, New Jersey. It is stated that if the ships are built singly they will cost about eight million pounds each, but that that cost can be almost halved by constructing the six at one time. Mr. Laurence Wilder, in introducing the proposal to the committee, promised that the ships if built would maintain a speed of 33 knots for a distance of 7000 miles without needing to refuel. A normal complement of twenty-four aeroplanes is to be carried for commercial use, but it was suggested that in a time of national emergency accommodation could be arranged for about one hundred machines. The provisional designs for these vessels show a long flat deck free from obstructions, which would serve as a taking off platform.

The Stockport Turbo-generator Set.

AT a special meeting held on Monday last, the Stockport Town Council decided by a majority of one vote to accept the tender of Escher, Wyss and Co. for a 20,000-kW turbine. As reported in our last issue, the lowest British tender was originally £52,000, but after the tender of the Swiss firm had been accepted a British firm offered to carry out the contract for £42,000. In consequence of that offer it was decided at a meeting held on February 15th to rescind the resolution accepting the Swiss tender and to place the work with this British firm. At the special meeting held on Monday last, however, the decision was again reversed, and Escher, Wyss and Co., Ltd., have now definitely secured the contract. Sir Thomas Rowbotham, who appears to have been largely responsible for persuading the Council to accept the Swiss tender, argued that Escher, Wyss had acted straightforwardly, whereas the British firms had not. The British firm that had offered to carry out the work for £10,000 less than the original price it quoted had not sent in its offer in the proper way, and personally he would not have given the firm the order if it had reduced its price to the same level as that of the Swiss firm. The chairman of the Electricity Committee said that members of the British Electrical and Allied Manufacturers' Association had admitted that they could not tender individually and could not modify their tenders without going back to London and calling a meeting of their Association.

A New Glasgow Bridge.

ON Monday of this week, February 27th, the George V. Bridge over the river Clyde at Oswald-street, Glasgow, was formally opened by the Lord Provost of the city, Sir David Mason. Work on the new bridge, which is intended to relieve the traffic congestion in the centre of the city, was begun nearly four years ago, and in July last a memorial stone was laid by the King. The bridge has a width between parapets of 80ft., and a total length of 420ft. It is a three-span structure, and is slightly skewed, the angle between the river and abutment piers and the bridge centre line being 79 deg. Each of the side spans is 128ft. 9in. and the centre span is 166ft. in length. The entire bridge is of Considère design, and it has been constructed in conformity with the requirements of Mr. Thomas Somers, M. Inst. C.E., the Master of Works and City Engineer of Glasgow. In an article which appeared in THE ENGINEER of January 15th, 1926, Mr. W. L. Scott, Assoc. M. Inst. C.E., described fully the construction of the bridge and the method of sinking the reinforced concrete caissons. The contractors for the work were Messrs. Melville, Dundas and Whitson, of London and Glasgow. It is claimed that the George V. Bridge is one of the most important reinforced concrete structures which has yet been built in Great Britain. We are given to understand that the total cost of the bridge will be between £250,000 and £300,000, part of which will be met by the Ministry of Transport, the remainder being shared equally between the Statute Labour Department and the Tramways Department of the Glasgow Corporation.

The Newcastle-Gateshead Bridge.

IN last week's issue we reproduced a photograph which showed that the main arch span of the Newcastle-Gateshead Bridge across the Tyne had almost been completely erected. Actually the junction of the two parts built out from either bank was effected on Saturday of last week, February 25th. The bridge is being erected by Dorman, Long and Co., Ltd., under a scheme devised by their consulting engineers, Mr. Ralph Freeman and Mr. G. C. Imbault. It is of particular interest not only because it is the largest arch bridge in this country—the arch span measures 531ft.—but because in general design and in the method of its erection it reproduces on a small scale the features of the 1650ft. arch span of the Sydney Harbour Bridge now in course of construction by the same firm. The Tyne Bridge will have footways and a carriageway with a double line of tramway track and will not carry a railway as well, as the Sydney bridge will do. In our issue of December 30th, 1927, we gave diagrams and a description of the method of erecting the Tyne bridge. It need here only be said that the halves of the arch were built out from either bank of the river simultaneously by means of a crane equipment which laid its own track on the upper booms of the arch as the construction proceeded. No false work was employed, the whole weight of the growing portions being supported by cables connected to the top booms and carried back over temporary masts to anchorages on the webs of the approach spans. The work of joining the halves at mid-stream was effected by slackening off the cables until the top cords met. A temporary pin was inserted to take the thrust between the upper cords at the junction, and after the halves had met on this pin the lower cord was completed by the riveting into it of a member compressed by jacks to the extent required to represent the compression of the member when under its final load. The roadway is suspended from the arch by steel hangers and will, it is hoped, be available for traffic at the end of September, although the bridge as a whole will not be completed until next spring.

The New Destroyer Orders.

GENERAL satisfaction is felt, both on the Clyde and Tyne, with the large proportion of orders for the eight new destroyers which have been placed with Northern shipbuilding firms. Out of the eight vessels, four are to be built on the Clyde. Two will be constructed at the Clydebank yard of John Brown and Co., Ltd., and two by Scott's Shipbuilding and Engineering Company, Ltd., of Greenock. On the Tyne two destroyers will be built by Hawthorn, Leslie and Co., Ltd., and one by Swan, Hunter and Wigham Richardson and Co., Ltd. The remaining vessel will be built by Vickers-Armstrongs, Ltd., at Barrow-in-Furness. The Swan-Hunter-built vessel will be the flotilla leader of the group, and it is understood that the contract for a further destroyer, making nine in all, has yet to be placed. It is a matter of comment that neither John I. Thornycroft and Co., Ltd., nor Yarrow and Co., Ltd., to which the designing and building of the "Amazon" and "Ambuscade" were entrusted, and which have kept up establishments to deal with this work, are to share in the present programme of construction. In view of their special experience of the types the only possible deduction is that their prices were above those of their competitors—from which our readers may draw their own conclusions.

The Scottish Electricity Scheme.

THREE firms, namely, the Metropolitan-Vickers Electrical Company, the English Electric Company, and Ferranti, Ltd., are to share in the provision and erection of the 132,000-volt transformers for the Central Scotland electricity scheme. The orders comprise the transforming plant at fourteen stations associated with the overhead primary transmission system, the total transforming capacity being 810,000 kilovolt-ampères. It is understood that the value of the contracts placed already amounts to over £400,000. In connection with the overhead transmission line system, an important modification of the route in the northern section is to be made. Originally it was proposed to cross the river Tay at a point considerably east of the Tay Bridge, approximately, from Tayport to a point a little west of Broughty Ferry, the idea being to carry a cable across the Firth with one great span, from high steel towers on either side. In view, however, of the amount of shipping at this part of the estuary and the potential danger to navigation of a 132,000-volt cable, it has now been decided to cross the Tay somewhere in the neighbourhood of Perth, and probably at a point near the mouth of the Earn. This modification will involve the abandonment of the proposal to carry the main transmission line through Cupar and Kilmany to Tayport, and the adoption of a new route, probably through Ladybank, Auchtermuchty, and Newburgh, to the point where the line will cross the river, and then along the Carse of Gowrie to Dundee. The section of the line between Dunfermline and Dundee is due to be completed at the end of next year.

Railways and Road Transport.

ON Tuesday of this week, February 28th, the House of Commons began to take the second readings of the Road Transport Bills promoted by the five main railway companies. The five Bills are similar or identical, and accordingly the debate was confined officially to but one of them, that standing in the name of the London, Midland and Scottish Company. The Bills have created an interesting political situation in that they have caused a temporary breakdown of the party system. For example, in the Labour party the representatives of the railway workers' unions are strongly in favour of the Bills, while the representatives of the general transport workers are as strongly opposed to them. During Tuesday's debate opponents of the Bills argued that the companies already had 35,000 vehicles on the roads, of which 4000 were motor vehicles, and that they had already lost £3,000,000 on this section of their work. It was also argued that if the companies obtained the powers which they sought they would be in a position to force a large number of haulage contractors to shut down their activities. In favour of the Bills it was urged that the companies paid nearly £8,000,000, or 20 per cent. of their earnings, in rates, and that they were entitled to fair play and a fair opportunity of working their own road traffic. Against the suggestion of the opponents of the Bills that the companies, having driven competition off the roads, would withdraw their road vehicles with the object of forcing the traffic to return to the railways, it was argued that any such policy would be suicidal. Immediately it was put into practice and became effective competition would reappear. The debate was continued on Wednesday.

The Second Reading Carried.

DURING the second day of the debate on the L.M.S. Bill, the opinions expressed by the majority of the speakers were heavily in favour of the railway companies. One member advanced the case of the London Underground Railways and Omnibuses, which are run under unified control, and stated that the pooling arrangements in force resulted in the omnibuses contributing £500,000 each year towards the upkeep of the tubes. Another said that the approximate value of the commercial and passenger vehicles at present using the roads was estimated at £134,000,000, and that it was ridiculous to suppose that the railway companies could expend any such sum as they would have to do if they desired to drive all competition off the roads. On behalf of the railway companies, the proposal was made that no regular service, other than experimental, which they established should be withdrawn without public notice being given to enable anyone opposed to the withdrawal to lodge objections with the Ministry of Transport. The Minister of Transport himself favoured the Bill, and intimated that he would recommend at the Committee stage that additional safeguards and clauses should be inserted in it. One such safeguard, he said, would be to make it obligatory on the companies to obtain the consent of the Ministry of Transport to the establishment of any proposed road service, and to obtain permission from the Ministry if, after the service had become firmly established, the companies desired to withdraw it. He added that he understood that the companies had already offered to the manufacturers of road vehicles that they (the companies) would not undertake the manufacture of the vehicles or their parts, except the bodies. He proposed to recommend that an agreement in that sense should be embodied in the Bill. Eventually, the second reading of the L.M.S. Bill was carried by 399 votes against 42. The Bills of the four other companies were thereupon given a formal second reading without a division. It is to be noted that the second reading of a private bill does not carry with it the same measure of approval as does the second reading of a public bill and that the House may yet reject the Bills after they have been examined in Committee.

Reconstruction of New Holland Pier.

NEW HOLLAND pier is situated at New Holland on the Lincolnshire side of the river Humber, to the south-west of Hull, from which it is distant about 2½ miles. It was constructed over seventy years ago and provides the only adequate means of connection between the Yorkshire and Lincolnshire shores of the river. Trains run to the pier head, and the river crossing is effected by a service of ferry boats.

The pier, which is 1370ft. long and 35ft. 6in. wide, was originally constructed of timber, and consisted of twenty-seven bays with a tee head landing stage, 580ft. long, with sloping landings and gangways for berthing the boats. There is a passenger station at each end, a double line of rails, a footway for pedestrians along the eastern side, and a roadway for vehicles, cattle, &c., along the western side. The depth of water at the pier head at high water is 33ft. and at the shore end 9ft., and there is a range of tide of about 23ft. Rail level is 8ft. above high water.

The strata of the bed of the river consists of warp to a depth of about 46ft. below high water, then gravel and sand, and the chalk is reached at a depth of about 60ft. below high water. During the years 1889 to 1892 the pier was strengthened by the addition of extra trusses between the supporting trestles, and three years later was seriously damaged by fire. In 1912 its condition was such as to necessitate considerable renewals of the longitudinal timbers and other repairs, and in 1916 a recommendation was made to rebuild the first twenty-one bays of the pier, leaving over for the time being the reconstruction of the portion carrying the pier head station. But the war intervened and the work was postponed.

FIRST CONTRACT.

In 1922 a part reconstruction in the form of additional supports was ordered, and a contract was let in August of that year to Messrs. Logan and Hemingway, of Doncaster, for the strengthening of the first twenty-one bays. This work consisted in the sinking of forty-four steel and cast iron cylinders. Two cylinders were sunk in each bay, midway between the timber trestles, so as to halve the spans, with a heavy bracing connecting the cylinders at the tops, it being the original intention to strengthen the existing timber structure by supporting the timber longitudinals of the pier from these bracings and, at a later date, to erect a new steel superstructure to be carried on the cylinders. The two cylinders in each bay were sunk at 25ft. centres, except in bays Nos. 1, 2 and 3, 18 and 19, where the distance varied up to 34ft. to suit the widening out of the pier at both the shore and pier head ends, and in bays Nos 20 and 21 three cylinders were sunk in each bay to give the necessary increased width, the maximum distance apart of the cylinders being 37ft. centres. In a longitudinal direction the cylinders were spaced at 50ft. centres.

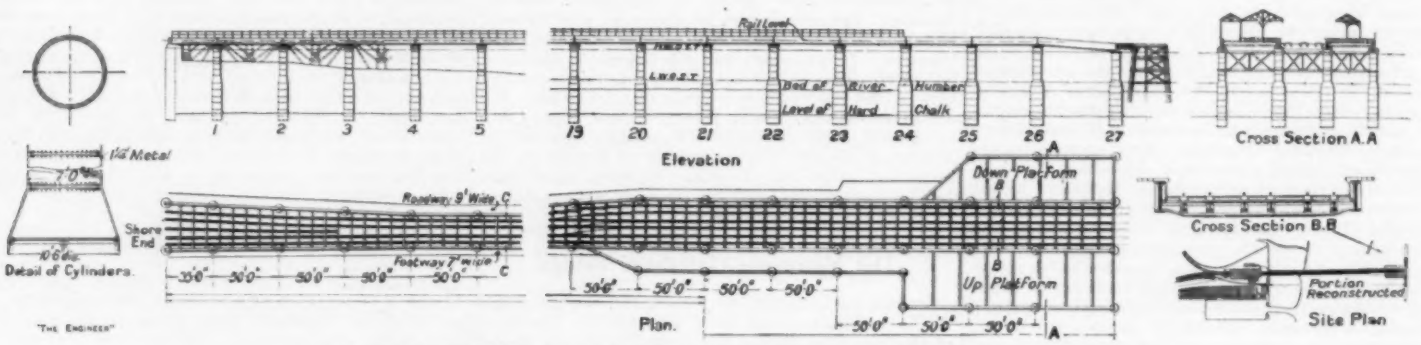
The cylinders are of cast iron and steel. The steel sections extend from a few feet below L.W.O.S.T. to foundation level. These sections are 7ft. 6in. diameter and 5ft. deep, with plates ½in. thick. Each section is made in two halves, the plates having butt joints with 6in. by ½in. covers on the outsides, attached by ¾in. rivets, 3in. pitch. Round the top and bottom of each section is an internal 4in. by 4in. by ½in. angle iron ring welded at the joint. These angles are fixed ¼in. from the ends of the sections so as to leave a 4in. by ½in. space all round the cylinder between the horizontal limbs of the angles for caulking when the sections are in position. The angles are attached to the sections by ¾in. rivets 3in. pitch, and when in position the sections were bolted together through the angles by 1in. diameter bolts about 8½in. pitch in holes 1 1/16in. diameter. The butting ends of the sections are machined. The cutting plate consists

CROSS SECTION OF PIER ON LINE C.C.

of a 12in. by 1in. steel ring, 7ft. 6in. internal diameter, riveted on to the bottom section. This projects 1½in. below the bottom end of the section and is chamfered off on the inside from 1in. to ¼in. thick to form the cutting edge. The rivet heads on the outside of the cutting plate are countersunk to facilitate sinking, and the joint cover strips on the outside of the steel sections are tapered and housed under the cutting plate for a length of 3in. to ensure water-tightness.

The cast iron sections, which extend above low water, are 6ft. external diameter, 1½in. metal, and the general length is 4ft. 6in. These sections have internal flanges 4in. by 1¼in. top and bottom for making the connections. The top flanges are machined the full width of 4in., but the bottom flanges are only machined for a width of 1½in., the remainder of the flange being recessed ¼in. for caulking. When in position the cast iron sections were bolted together with twenty-four 1in. diameter bolts in 1 1/16in. diameter holes at about 8½in. pitch.

The section adjoining the steel sections is special, reducing from 7ft. 6in. diameter to 6ft. diameter, and in addition the flange width is increased to 4½in. with a corresponding increase in the limb of the flange angle on the top steel section. For erection purposes the length of this section was reduced from 5ft. to 4ft. 6in. The length of the top cast iron sections is 3ft. 6in., and on to each is cast a projecting band 6in. wide by 1in. deep to hold the steel bracing in position. A making-up length of variable depth is also provided in each cylinder.



PART ELEVATION, PLAN AND SECTIONS OF RECONSTRUCTED NEW HOLLAND PIER

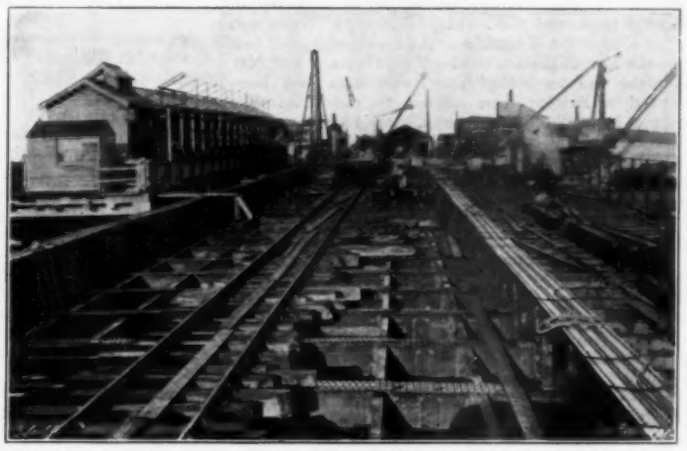
Sinking was started in April, 1923. As the cylinders are directly underneath the roadway on the west side and under the footway on the east side of the pier it was necessary to divert the road from the western to the eastern side, whilst the cylinders on the west side which were the first to be sunk were put down. The cylinders were sunk between guide piles driven from the pier, the sections being lowered through openings made in the timber decking, the contractor's crane for lifting the sections working from the running line on the pier when it was available. The first cylinder was founded on the gravel in July, 1923, at a depth of 49ft. below high water level, it not being considered necessary to go through the ballast to the chalk below, the gravel being quite firm and compact. Similar foundations were reached with the remainder of the cylinders, with the exception of cylinders in bays Nos. 18, 19, 20 and 21, which were carried down to the chalk rock.

The excavation from the cylinders was removed by grabs working from the deck of the pier, the bottoms of the cylinders being completed by hand, divers being employed when necessary for this purpose. In the case of the ten cylinders in bays Nos. 18, 19, 20 and 21, which were taken down to the chalk rock, it was found necessary to use an air lock. The last of the cylinders on the western side was founded in April, 1924, the maximum depth below high water level being 59ft.

The sinking of the cylinders on the eastern side was begun in April, 1924, and the last cylinder was founded on November 24th of that year, the maximum depth being 63ft. below high water. Two additional cylinders were also sunk on shore to provide a bearing for the shore end of a new superstructure, the existing river walling being insufficient for the purpose. These cylinders consisted entirely of steel sections, and were sunk to a depth of 50ft. below high water down to the gravel. Compressed air was used, as the material passed through could not be grabbed out.

The hearting of the cylinders consists of concrete of the following proportions: four of gravel or broken stone, two of sand, and one of cement. Where the cylinders were sunk without the use of compressed air, *i.e.*, in bays 1 to 17, the first 15ft. of concrete was deposited through the water by means of a drop bottom box, and after it had set the water was pumped

CONCRETE CASING TO STEELWORK. CONTRACT NO. 2



TOP OF PIER DURING CONSTRUCTION. CONTRACT NO. 3

out and the remainder of the concrete deposited in the dry. The cylinders and concrete were finished off at a level of 6ft. 3in. below the rail level on the pier, and holding-down bolts and rail dowels were built into the concrete to provide an anchorage for the concrete caps and the new steel superstructure.

The cylinders are braced together at the top by a steel bracing, 9ft. 6in. deep overall, built in the form of a lattice girder, the original intention as stated being to support the existing timber longitudinals from this bracing. The top member consists of a horizontal plate, 30in. by ⅝in., two vertical side channels, 15in. by 4in. by 41·94 lb.; and two 4in. by ⅝in. flats; and the bottom member, two vertical plates, 1ft. 9in. by ⅝in.; 1ft. 11½in. apart, and four angles, 4in. by 4in. by ⅝in., with diaphragm plates in both members. The four diagonals and one vertical member in each

COMPLETED PORTION OF PIER UNDER CONTRACTS NOS. 1 AND 2

TEMPORARY GANGWAY FOR ROAD TRAFFIC AT PIER HEAD

set of bracing are built up of two channels, 15in. by 4in. by 41·94 lb., connected together with 1ft. 10in. by 1ft. by ⅝in. plates.

The attachment to the cylinder is by means of ⅝in. bent plates riveted to the top and bottom members of the bracing, and to the two halves of a steel strap, 1ft. 3in. deep by ⅝in. thick, which is bolted together round the cylinders.

SECOND CONTRACT.

As the work in connection with the sinking of the cylinders proceeded it became possible to make a more detailed inspection of the timber superstructure of the pier as disclosed at those places where the timber decking had to be removed. The result was such that it was decided to proceed at once with a new superstructure, to be erected on the cylinders then being sunk under the first contract, and a contract for carrying out the work was let in February, 1924, to Sir William Arrol and Co., Ltd., Glasgow. The work included the removal of the timber superstructure, trestles, bracings, piles, &c., in the old pier between the shore and the pier head station as far as the cylinders had been sunk under contract No. 1 for the first twenty-one bays, and the erection of the new steel work, concrete casing to girders, longitudinal timbers, planking, &c.

This new superstructure provided for a double line of railway on the pier, with a 9ft. roadway on the western side and a 7ft. footway on the eastern side of the pier, and consists of two main longitudinal plate girders, cross-girders and rail bearers with a timber floor, the road and footway being bracketed out from the main girders. The main girders are carried on the cast iron cylinders and span the 50ft. distance between the centres of the cylinders. In spans 4 to 17 the girders, which are 4ft. 10in. deep over angles, are placed 25ft. apart, centre to centre, and are connected by plate cross girders 1ft. 10in. deep over angles at 10ft. centres, which, in turn, carry the four rail bearers.

The rail bearers, which are spaced at 5ft. and 7ft. centres, the two tracks on the pier being 7ft. apart, consist of 15in. by 6in. by 59 lb. R.S. joists, supported on 6in. by 6in. by ⅜in. angle brackets attached to the cross girder webs, and also riveted to the cross girder webs through 7in. by 7in. by ⅜in. angles.

The whole of the steel work is completely encased in concrete to afford protection from the effects of the weather and sea water; the undersides of the main girders, being only about 3ft. 6in. above H.W.O.S.T., are frequently exposed to the action of the salt water. This concreting was all carried out *in situ* after the erection of the steel work, the concrete being in the proportion of one bag of cement weighing 224 lb. to 9 cubic feet of aggregate, consisting of gravel or stone with sufficient sand to fill the voids. The size of the aggregate was such as to pass through a ¾in. gauge and be retained by an ¼in. gauge. The concrete is reinforced with No. 14 B.R.C. fabric, which is wrapped round the main girders, cross girders and rail bearers to the desired form, horizontal longitudinal ⅝in. diameter rods, passing through holes in the stiffener angles, being provided in the main and cross girders for the attachment of the fabric. The concrete follows the form of the girders and is 10½in. thick across the web in the case of the main girders and 5in. in the case of the cross girders. The minimum cover is 2in. The concrete on the top flanges of the main girders is finished to a height of 2ft. above rail level, and forms the coping to the footway and roadway on each side of the pier, the roadway coping being finished with a vertical concrete kerb 9in. high and 9in. wide, to prevent vehicles from running off on to the rails. In addition, the concrete to the roadway is topped with 1½in. rock asphalt.

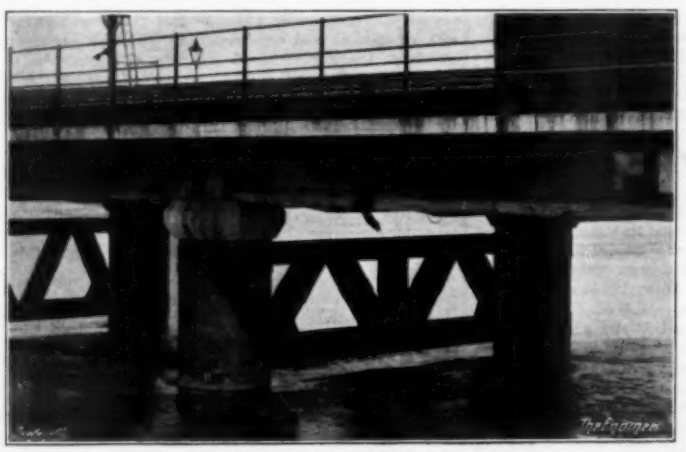
The concrete surrounding the rail bearers, which are 15in. by 6in. joists, is moulded to a tee section, the stem being 9in. wide and the head 1ft. 6in. wide and 7in. deep, thus forming a seating for the longitudinal timbers carrying the rails.

The timber decking of the pier between the main girders is of creosoted fir. Longitudinal timbers 18in. wide and 9in. deep, run directly under each of the four rails, and are carried over the rail girders on the concrete casing as described above, a layer of hair felt being provided between the concrete and the timber. The timbers are bolted through the concrete tee head with 1in. diameter bolts, four being used in each rail bearer.

Between the longitudinals and between the longitudinals and the main girders 6in. by 6in. transomes and bearers are fixed at 5ft. centres. These are housed into the longitudinal timbers and rest on angle cleats attached to the main girder webs and act both as struts and bearers for the planking. Each pair of longitudinals carrying the rails is bolted together alongside each transome with 1in. diameter tie rods. The planking is 3in. thick and is nailed to each transome and bearer with No. 2 6in. rose-headed cut nails. The planks are laid with open joints of about ¼in. opening.

To provide for the expansion of the steel work in a longitudinal direction the longitudinal timbers are jointed by means of two 1ft. 10in. by 9in. by ⅜in. steel flats bolted through the timbers with slotted holes, leaving a ¾in. joint, which occurs over the first cross girder in each span, where provision is also made for movement in the rail girders. In addition, the planking is also jointed over the cross girders, leaving a ¾in. space between the ends of the planks, which are supported from the cross girders by 6in. by 3in. bearers. In order to provide for the rail crossovers on the pier the decking, where they occur, consists wholly of 9in. planking supported on 12in. by 6in. rolled steel cross joists fixed between and carried by the rail bearers at 3ft. 4in. centres.

Fine concrete caps, 2ft. 7½in. deep and octagonal in shape, are built *in situ* on the tops of the cylinders, to which they are attached by means of five dowels of rail section left projecting from the concrete hearting of the cylinders. Through these caps also pass the four 1in. diameter holding down bolts, also built into the concrete hearting of the cylinders. The main girders are bedded on a cement seating on top of the concrete caps, and are bolted down to the four projecting bolts, being fixed on the bearings at the shore end of each span and free at the river end,



CYLINDERS AND BRACING

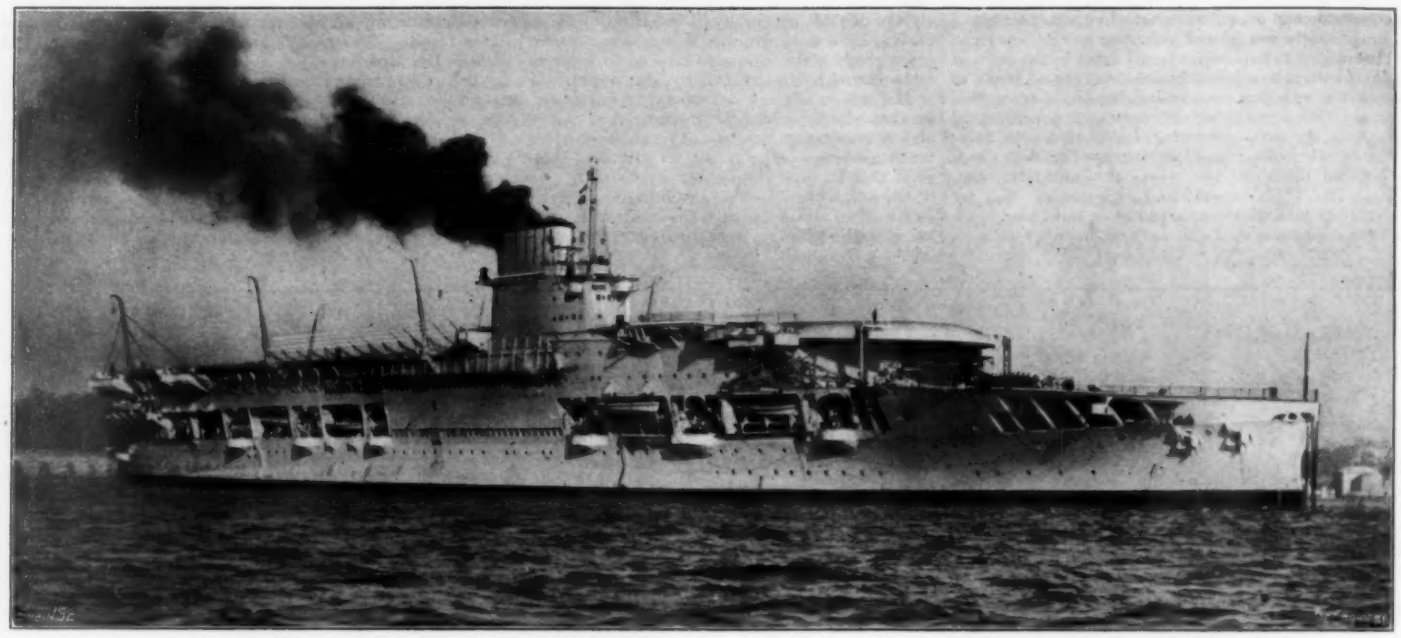
HEAD OF CYLINDER AND ENDS OF MAIN GIRDERS

slotted holes being provided in the bearing plates for expansion.

The 9ft. roadway on the west side and the 7ft. footway on the east side of the pier are carried on steel cantilever brackets attached to the gussets of the main girders, and consisting of 7in. by 3½in. and 6in. by 3in. channels respectively. The brackets are spaced at 10ft. centres opposite to each cross girder and carry attached to their outer ends a horizontal channel of similar section. From them 6in. by 3in. channels are carried across to the main girders at intervals of about 3ft. 4in. so as to form intermediate bearers for the 6in. planking.

The whole of these brackets were encased in concrete after erection, having first been wrapped with No. 10 gauge wire spirally wound at 3in. pitch to form a key for the concrete. The floor of both the roadway and footway is of 6in. longitudinal planking, laid with open joints on 11in. by 4in. bearers bolted through the channels. The planking is also bolted to the bearers with two ⅝in. diameter bolts to each plank, provision being again made for expansion in a similar

H.M. AIRCRAFT CARRIER COURAGEOUS



manner to that adopted for the decking of the pier alongside the rails.

An open hand rail parapet, consisting of angle iron standards and gas tube hand railing is fixed on both sides of the pier, the standards being attached to the longitudinal channels carried by the brackets.

The designs of the shore span, 35ft., and spans 1, 2 and 3, are similar to spans 4 to 17, with varying lengths of cross girders to suit the widening out of the pier in these spans, and also additional rolled steel joists are provided between the cross girders and between the rail bearers, with variations in the thickness of the deck planking to suit the arrangements of the permanent way.

At the shore end a mass of concrete, 3ft. thick and 5ft. wide, and reinforced with old steel rails, was laid between and over the two cylinders sunk on the shore to carry and form a bearing for the main girders and rail bearer ends. This concrete was carried forward in the form of an apron to act as a coping to the existing timber sheet piling alongside the river.

During the erection of the superstructure, railway traffic to and from the pier head station was suspended, except the passage of wagons of coal and stores for the steamers, it having been deemed advisable to do this owing to the condition of the pier, and the contractor had to arrange his work so as to admit of the passage of such wagons as and when required, and also to provide means for working them to and from the pier station, and also to provide facilities for pedestrian and vehicular traffic.

THIRD CONTRACT.

Whilst the above work was in progress a further examination was made of the timber work forming the portion of the pier carrying the passenger station at the pier head, and, as a result of this, it was considered advisable to take in hand the reconstruction of this part of the pier as a continuation of the work then in hand, and a further contract was let to Sir William Arrol and Co., Ltd., in November, 1925. The work included the entire reconstruction of the sub-structure and decking under the Pier Head Station, together with the removal and reinstatement and rebuilding of the station buildings, roofing and cattle pens, &c. The reconstruction of the Tee landing stage and covering were not included in the contract, and have not been carried out.

Following the work carried out under contracts Nos. 1 and 2, six further spans of 50ft. and one of 60ft., have been constructed, necessitating the sinking of six pairs of cylinders carrying the main carrying girders on each side of the three rail tracks and ten outside cylinders for the support of the platforms and station buildings. These cylinders were of larger diameter than those in Contract No. 1 to allow for the increased loading due to the larger spans.

On the eastern side a suspended floor is provided in two of the 20ft. bays, giving a depth of 7ft. below the decking of the platforms, to provide room for the heating apparatus and also a cellar in connection with the station buildings. This floor was of reinforced concrete carried on rolled steel joists suspended from the cross girders connecting the inner and outer main longitudinal girders. The sides of these chambers are of reinforced concrete, 8in. thick. Throughout, the steel work is encased in concrete, as described under contract No. 2, the concrete being laid *in situ*. Suitable provision is also made for expansion. The connection between the newly constructed floor and the existing berthing stage at the pier head, which has not been renewed, has been suitably made up of timber.

The work is now completed, and the pier will shortly be reopened for rail traffic. The new pier has been designed to carry British Engineering Standards Association unit loading—eighteen units—on both roads simultaneously, thus providing for the heaviest rolling stock. The roadway is designed for an 8-ton motor car and 120 lb. per square foot, and the footway and platforms for 120 lb. per square foot. The erection of the signal-box on the platform near the pier head station was carried out by the company's signal department, and the final reinstatement of the hydraulic water and gas mains along the pier is being carried out by the company themselves.

The accompanying drawing and half-tone engravings illustrate the works.

The work has been carried out to the designs of Mr. C. J. Brown, C.B.E., M. Inst. C.E., engineer, Southern Area, London and North-Eastern Railway, and Mr. Harry Blundell, M. Inst. C.E., formerly engineer of the Great Central Railway—who was responsible for the designs for the work under contract No. 1—and under the immediate supervision of Mr. R. F. Bennett, M. Inst. C.E., assistant engineer (construction). Mr. A. C. Gardner, M. Inst. C.E., superintending the work at the site.

H.M.S. Courageous.

H.M. Aircraft Carrier "Courageous" is now undergoing her steam trials, and in the accompanying engraving we illustrate her as she appeared when leaving Devonport. She was originally laid down at Armstrong's yard in May, 1915, as a "light battle cruiser." A sister ship, H.M.S. "Glorious," was laid down by Harland and Wolff at about the same time, while a third vessel of a slightly modified type, H.M.S. "Furious," was begun shortly afterwards by Armstrong's. These three vessels were constructed to give effect to plans formulated in 1915 by the late Lord Fisher for operations in the Baltic, and were as a consequence designed with fine lines and a shallow draught. The Baltic operations were never carried out. It is understood that on her trials the "Courageous" strained her hull forward in heavy weather, and had to be strengthened. Similar reinforcement was subsequently applied to her sister ship "Glorious." As light battle cruisers these two vessels were only once in action during the war, and it is stated that on that occasion their protection, confined to a 3in. belt, proved insufficient to resist the attack of the guns of light cruisers, and that their limited number of big guns made effective salvo firing impossible. H.M.S. "Furious" took no part in the war as a light battle-cruiser, for almost as soon as she was completed she was rebuilt as an aircraft carrier. In that guise she served as the starting point of the very successful air raid against the German airship sheds at Tondern, Schleswig-Holstein. After the war she was refitted, and in 1925 made her appearance in a completely altered form. Her funnel and mast were removed during this refit and arrangements were incorporated in her structure for discharging her smoke through vents at her after end or, alternatively, in the flight deck.

In 1924 the work of converting the "Courageous" and "Glorious" into aircraft carriers was begun. As our engraving shows, the use of a funnel for the discharge of the smoke has been reintroduced in the case of the "Courageous." The work of converting this vessel is estimated to have cost £2,025,000. It is stated that she will be capable of accommodating six flights of aeroplanes in her hangars. Particulars of her performance and armament have not been disclosed, but in her original form as a light battle-cruiser she was driven by geared turbines of 90,000 S.H.P., and had a speed of 31 knots. The "Glorious" has still to be completed. It is understood that she will probably be found to differ from the "Courageous" in her general lay-out.

The other aircraft carriers of the British Navy are the "Hermes," a vessel begun in 1917 and designed from the outset as an aircraft carrier; the "Eagle," begun in 1913 by Armstrong's as a "Dreadnought" battleship; the "Admirante Cochrane," built for the Chilean Navy and taken over and converted in 1917; and the "Argus," begun in 1914 by Beardmore's as the Italian Lloyd Sabaudo liner "Conte Rosso," and purchased for conversion in 1916. Mention may also be made of the cruiser "Vindictive." This vessel was begun in 1916 as the "Cavendish," but was re-named and completed in 1918 as an aircraft carrier. During 1923–25 she was re-converted to a cruiser, but she still retains an aeroplane hangar and a launching catapult forward. She is therefore something of a cross between a cruiser and an aircraft carrier.

Ratefixing.

By G. W. TRIPP, A.C.G.I., M.I. Mech. E., A.M. Inst. C.E.

EMPLOYERS generally are agreed that some form of payment by results is the most equitable as well as the most satisfactory method of remunerating the producers of the goods manufactured in their factories. But it frequently happens that the employees look askance upon the different schemes that have been evolved, and endeavour to restrict their application, an attitude attributable, at least in part, to the fact that they have not always had a "square deal." If it had been more generally understood that it was essential to ensure the goodwill and support of all concerned, many pitfalls would have been avoided. It is not our intention to explore the different systems, but rather to presuppose a factory using straight piecework, which has the advantage of being better understood by the worker, as well as being also the basis of all those developments which have sprung into existence in an attempt to minimise the effects of bad, or even indifferent, ratefixing, a palliative rather than a cure, the cure being to provide good ratefixing.

Payment by results, however deduced, necessitates ratefixing, which may be defined as the art of determining the time required to produce an article or articles of a sufficiently high standard to pass the inspecting official. The subject can perhaps most suitably be approached by considering four different aspects :—

(1) The type of individual required.
(2) General principles.
(3) The method of ratefixing.
(4) Organisation.

(1) *The Ratefixer.*—It is desirable to commence with the individual as so much is dependent upon the

personal equation; indeed, if the actual ratefixing were as near to perfection as is humanly possible, but the ratefixer himself lacked those attributes that are so essential to his position, the results would be deplorable. Yet, having stated this as a fact, it is none too easy clearly to define the most suitable man for a ratefixer without setting the standard too high to be practicable. In an engineering factory he certainly must have served a recognised apprenticeship, and have had some experience as a journeyman, while it is highly desirable that he should have spent some time in the drawing-office, acquiring the ability to read drawings readily and to visualise each part rapidly and accurately. A mistake is too frequently made by selecting one of the most rapid mechanics for a ratefixer, ignoring the fact that good ratefixing must cater for the man of average ability, which the really fast mechanic finds it very difficult—indeed, almost impossible—to do.

Having enunciated the practical training requisite, the personal qualifications, which no amount of training can supply, require very careful consideration. A ratefixer must, above all, be tactful; but he must also have sufficient self-confidence to maintain his position and to uphold his opinion in the face of opposition, while—hardest of all—he must be big enough to admit a mistake when he has made one, and then to ensure rapid justice being done. A critic may aver that a paragon of virtue would be necessary to fill the bill, but it is surprising how many men can be found satisfying most, if not all, of the above requirements.

As years pass, the ratefixer becomes more and more proficient, but unfortunately this sometimes has a prejudicial effect on the individual, in that he suits the management so well that he is left where he is. It cannot be too strongly urged that a definite avenue of promotion should be available for the ratefixer, who ought to prove an invaluable foreman or under manager. Mobility in staff will tend to get the best work from everyone.

(2) *General Principles.*—Many promising schemes have come to grief owing to the apparent expediency of the moment being allowed to overrule what should have been established as fundamental principles, principles applied as rigidly as were the laws of the Medes and Persians. In the first place, it must be recognised, both in the office and in the workshops, that *the piecework card given to the workman constitutes a definite contract between him and his employer.* That being so, it should be regarded as essential that the card should be in the hands of the workman before he begins the work represented by that card. This will enable him to lodge any complaints, if he is of opinion that the price is unreasonable, without the taunt being hurled at him that he is half-way through the job before he discovers that he is not going to make it pay. But it must also be remembered that there are obligations on the other side, and it will prove to be an expensive bargain when the gain of a few pounds carries with it a definite loss of goodwill. A simple example will elucidate this point. Owing to an error, a piecework card was prepared giving a price per "each," when the price should have been per "set of three," and the card was accepted without comment by the operator. After the work had been completed, the mistake was discovered, the operator thereupon being accused of dishonesty for not pointing out that the price was too high. Eventually, a grudging consent was obtained that he had considered that the price was liberal, but by this time a bad impression had been created all round. If, on the other hand, no aspersion had been cast on his honour, but he had been informed that a mistake had been made and detected, and that he had been more lucky, in earning money so easily, than the unfortunate clerk who had got into serious trouble for his original error, probably genuine regret for not telling his foreman that the price was wrong would have been engendered. Few self-respecting men will like to score if it involves injury to a fellow-worker. Thus the future would have been safeguarded, while the prestige of the management in the eyes of the rank and file would have advanced materially.

Our next fundamental is that *once a price is fixed there must be no cutting of the rate.* The negation of this principle has done more to bring payment by results into disrepute among the workers than anything else. Better far to face an occasional "bad" price than to produce or foster feelings of suspicion and distrust. Should the rate be flagrantly wrong, it is advisable to change the whole method of manufacture, completely eliminating the offending operation. A merely camouflaged change of method is almost worse than a deliberate "cut," in that it is dishonest.

Another fundamental principle, closely allied to that just specified, is that *maximum output should always be encouraged.* This may at first sight appear to be an unnecessary maxim, but too frequently men are accused, directly or indirectly, of "earning too much," perhaps coupled with a veiled threat that the rate was wrong, and will have to be investigated. Foremen frequently offend in this regard, not appreciating that as the skill of the worker increases, so his output should improve. In this connection, the saving of time has the distinct advantage of reducing the "oncost," a consideration frequently overlooked by the shop staff, but one of far-reaching effect.

Finally, it must always be remembered that *rates should be fixed for the man of fair average ability.* The phenomenal mechanic should be allowed freely to reap the benefit of his exceptional skill, the firm making up in other directions. But should his times be taken as a criterion of what should be done, trouble is bound to arise.

While other recognised principles may be necessary to suit special circumstances, it is felt that if the four stated are regularly and conscientiously observed, a firm foundation has been well and truly laid.

(3) *Method of Ratefixing.*—Many articles have been written and papers read on the question of feeds and speeds, tables have been prepared giving a wealth of useful information and valuable statistics, but it must be confessed that, important though this is, it is only a small part of ratefixing, and one which could be performed satisfactorily by an intelligent junior.

Before going further it would be advisable to enumerate the chief factors that have to be catered for before a definite price can be assessed. If the work has to be done on a machine, the actual cutting times should be comparatively easily determined, for the skilled mechanic will have ready access to information as to suitable depth of cut, feed, &c., for a given material, which he can use intelligently, coupled with his knowledge regarding the tools he has available, and the maximum cutting speeds that can advantageously be used. He will soon build up his own records, to supplement published statistics, and to suit the requirements of his own factory.

Having determined the cutting time, he will have to consider what is generally termed "handling" time, which will include such items as centreing the work, putting it in a chuck, or doing any other things that have to be performed to each article, as distinct from those which are common to a batch. The handling time can be assessed fairly readily, and may be regarded as one of the "positive" functions, applicable direct to the piecework price.

The ratefixer will now proceed to add the appropriate allowances, and here it is that he will particularly have the chance to prove himself. The main items included in allowances are as follows:—

(*a*) Receiving instructions as to the work.
(*b*) Collecting the necessary tools and equipment.
(*c*) Setting up the job and finally dismantling it.
(*d*) Interruptions.
(*e*) Fatigue.

This list by no means exhausts the ordinary possible contingencies, while there will be others that must be catered for as they arise, always bearing in mind that average conditions are those that must be taken.

Now will be appreciated the necessity for having a skilled ratefixer. Obviously, not even the best and most expeditious worker can start a job at once; he must make his preparations, and if the time allowed for them be too little, he will tend to become "disgruntled" even before he has taken his first cut. If, on the other hand, the time allowance be too liberal, there will be no incentive to adhere to the prescribed lay-out of the work, or, better still, to improve upon it. If the job be properly planned, all the tool equipment will, theoretically, be provided, but, even so, a small allowance is desirable.

Too often it is stated that operators cannot make relatively small numbers pay, whereas with large numbers they are prone to earn too much—although, as has previously been stated, the latter is always a fallacy.

In good ratefixing it is essential that preparation times—*i.e.*, items (*a*), (*b*) and (*c*) above—should be kept absolutely distinct from operating times, separate prices for each being shown on the piecework card. If this were consistently done there would be less talk among operatives of jobs that do not pay, any losses due to uneconomical small numbers falling on the employer. There is no justification for expecting an order for small numbers to be executed at the expense of the pieceworker.

However ideal the factory, however expert the planning, it will be found that certain interruptions will take place during the course of the day, and it will undoubtedly tend to establish confidence in the good faith of the ratefixer if he can point to a definite time allowance for this particular item in his built-up rate. Again, it has been proved conclusively that a man cannot give of his best for the whole period or shift—hence the allowance called, for want of a better name, "fatigue."

How to determine the appropriate time for allowances of all sorts is difficult to decide, for they are unlike the operation times which may be termed positive, but undoubtedly the safest, best and most reliable is that generally known as "observation study." If this be undertaken in a secretive manner, with hidden stop-watch, the ratefixer and his chiefs deserve all the opprobrium that is hurled at them. The study should be open and frank, for the ideal ratefixer will always aim at commanding the respect of the worker. If the order be for a really large number, it will be most advantageous to manufacture outright the first article in the tool-room or some other appropriate centre, so that the ratefixer can secure a really reliable observation study. When this is quite impracticable, he will have to utilise studies that have been made openly in the course of former orders for stores that appear to be most generally comparable with those about to be priced. The study should always be long enough to take into consideration all the varying conditions, and not to disturb the equanimity of the operator.

When interruptions, other than those that are normally anticipated, occur, the best policy is to issue to the operator a new card to cover the time thus lost, this being appropriately charged to a special order for "delays," "waiting time," &c., these charges being carried to the oncost. All such cards should be subjected to the closest scrutiny of the management.

Skilful though the ratefixer may be, when it is remembered that he always attempts to satisfy average conditions, cases will inevitably arise where it is a physical impossibility to perform the work for the money allowed. One of the most fruitful sources of trouble is material where a greater degree of hardness necessitates slower cutting speeds. If the contention of the machinist be a sound one, the ratefixer should not be persuaded to alter his price—unless, indeed, he is satisfied that the condition of the material is *normal*, whereas he had presupposed a freer cutting substance. If the material be actually harder than the average, he should issue an additional price for that particular batch, without touching the standard fixed rate. Justifications for *temporary* modifications may frequently arise, but these should never be confused with altering permanent prices; indeed, these temporary prices will always be additionals, never cuts.

While a machinist ratefixer should be able to assess rates for all classes of machine work, in a smaller concern he may be expected also to fix rates in the fitting shop. Here and in the more specialised trades there is no royal road to success, ratefixing being largely a matter of experience. It should be borne in mind that in the modern factory the fitter is becoming more and more an assembler, with theoretically no removing of material to undertake.

(4) *Organisation.*—The organisation of a ratefixing department is largely dependent on the other departments, as well as on the size of the factory and on the nature of its products, but the head of the department should be a fully trained engineer, with broad vision, and he must not be in any way subservient to any of the workshop management staff. He should be able to meet the managers of different sections on an equal footing. He will have an assistant in charge of the ratefixers dealing with each of the several departments of the factory, except in very small concerns, and he will have a clerical section which will be responsible for the preparation of all the piecework cards, as well as for filing all the departmental records.

Each ratefixer will be a specialist in his own trade, for it would be idle to expect a blacksmith to ratefix a turning job, or a turner to fix the moulder's time; but the efforts of all the different ratefixers will be scheduled on the appropriate forms and sent to the ratefixing departmental office, where they will be used in the preparation of the cards for the pieceworkers, and also built up in the form of a summary to be passed on to the estimating department.

Where the ratefixer should be located is a very vexed question, there being two schools of thought, each seeing little, if any, virtue in the opposite view. One will argue that there is only one place, and that the workshop, where he is in close touch with production, seeing all that takes place, and noticing for himself any signs of slackness or of unsuitable methods, while he will be regarded by the rank and file as one of themselves, one who knows every detail of the work, and is influenced by the environment of the factory. But this very proximity has serious drawbacks, argues the opponent, in that it makes the ratefixer very careful not in any way to offend the susceptibilities of the workmen or foremen, and this tends to an undue liberality in his prices. If his room is in the main office, he acquires that intangible yet undeniable status inseparable from the office job, and also if hard pressed in an encounter, he has his office to which he can return, as to a fortress kept by his brother ratefixers. If there be a degree of aloofness produced by his position away from the factory, it is not without compensations, and the respect of the worker is increased—quite a valuable asset.

Certainly there must be some centralised *rendezvous* where the ratefixers can be assembled to break down a new job, if of any magnitude, and to allocate the component parts to the respective ratefixers; if some of the ratefixers are to be found in this centre, while others are scattered in the different shops, it is not so easy to get that co-ordination which is so essential. All things considered, it is suggested that a centralised ratefixing department situated in the main factory office, in close proximity to the estimating and the production departments, will yield the best results. But having said this, it is imperative that the ratefixer shall have free access to the shop or shops in which he is directly concerned, being furnished with a seat in the foreman's office, if possible, to which he can go if he wants to consult a drawing or to make some urgent calculations, without having to return to the office. A great advantage of centralised ratefixing lies in the possibility of summoning a conference at a moment's notice to inspect a batch of drawings, and give a spot figure for the labour charges to enable a rapid estimate to be prepared for tendering purposes. An estimating department is

severely handicapped when the ratefixers are distributed far and wide over a big factory.

How ratefixing assists estimating has been explained in an article on the latter subject,* in which an illustration was given of the ratefixer's schedule, on which the various operations and times are set out for the use of the estimator. Ratefixer's times are also largely used by the production department as the skeleton on which to build up the shop load diagrams, which are the basis of all the promises of delivery made by the administration.

It is frequently urged that it is desirable to form a committee to investigate all prices at their inception, and that representatives of the pieceworkers should serve on it; but the committee habit is one that can very easily be acquired, with the result that a large proportion of the time of responsible officials is spent away from their duties, while the actual gain is problematical. But it is vital that the worker should have access to the head of the ratefixing department, so that if his foreman refuses an appeal for a revision of price, the man can have the opportunity of discussing the situation; frequently, he will be convinced that the price was a fair one after all, because he has seen for himself the means by which it was determined; indeed, in some cases it has been found that a former antagonist has become the ally of the ratefixer, paradoxical though this may seem to be.

In conclusion, ratefixing never has been and never can be an exact science; variables are bound to occur not only in the materials operated upon, but also in the tools used and in the general conditions of work, while, more important still, there is always the psychology of the worker to be considered. It is suggested that if a little more time were devoted to the education of the pieceworker, to initiating him into the so-called mysteries of ratefixing, and to convincing him of the integrity of the ratefixer, while explaining the principles and methods upon which prices were based—in short, that if a serious endeavour were made to promote a more sympathetic understanding between all the grades concerned—much of the opposition, both active and veiled, to payment by results would vanish into thin air, to the benefit of production generally and to the distinct advantage of the manual worker. Unfortunately, this side of ratefixing has not in the past received the attention that it deserves. It should no longer be neglected, but rather be given a place of pre-eminence.

The British Industries Fair at Birmingham.

(*Continued from page* 210.)

SEVERAL estimates have been published as to the extent of the attendance at the two sections of the British Industries Fair at Birmingham and London, and there is no question that it has far exceeded all previous records; but within our experience there has been no overcrowding, as the gangways are of ample dimensions. On the occasion of the King's visit to Castle Bromwich on Thursday of last week there was, only naturally and properly, a considerable crowd of sightseers, and we heard one or two exhibitors complain about the check to real business caused by those visitors after the Royal procession had passed, but our impression is that, taken as a whole, the Fair has maintained its reputation as a business affair, not given up to frivolity. In our two recent Supplements and in our issue of last week we have given descriptions of some of the engineering exhibits at the Fair and continue our account below. The Exhibition closes to-day.

SHEFFIELD STEEL PRODUCTS.

An interesting exhibit of files is to be found on the stand of Sheffield Steel Products, Ltd. An old-time file-cutter carrying on his highly dexterous occupation of cutting files by hand attracts much attention from passers-by, and serves to emphasise the efficiency of the modern machine methods by which the bulk of the firm's files are now made. A novelty in the way of files which the firm is showing is a flexible warding file. This file is made of a special steel, and is specially heat-treated to give it flexibility. It may be bent or even hammered through a considerable angle without fracturing, and in spite of its flexibility is endowed with the normal amount of cutting hardness. This combination of flexibility and hardness in the one piece of steel is not a little surprising, but from our own inspection and trial we can vouch for the fact that both these qualities are present to a very marked extent. A warding file that will bend through a considerable angle before it breaks, and that if necessary may actually be bent to a given radius and used in the bent state, should be of great value to jig, tool and die makers and to others. A striking test of a Sheffield Steel Products file is set forth in a graphic form on the stand. A bar of 1 per cent. carbon steel, 1in. square and 74·6in. long, is exhibited. This bar represents the amount of metal removed, before failure set in, by one side of a 14in. hand bastard machine-cut file, 1½in. wide, when tested by the Sheffield Testing Works on an E. G. Herbert file tester. During the test the file made 208,000 strokes across the end of the bar. Up to about 120,000 strokes, by which time 60in. of the bad had been filed away, the amount of metal removed was roughly proportional to the number of strokes made. Thereafter, the cutting efficiency of the file began to fall off until at 208,000 strokes the file became worn out, according to the convention adopted for the Herbert machine. It may be added that in ordinary hand-filing operations, a performance approaching that given by the file in the testing machine would not be expected, because of the introduction of the human element.

* See THE ENGINEER, March 7th, 1924.

DAVEY, PAXMAN AND CO., LTD.

On the stand of Davey, Paxman and Co., Ltd., Colchester, the principal exhibits are two oil engines, both of which are shown running. One of them is the single-cylinder set shown in Fig. 16, while the other, which is quite new, is the six-cylinder engine illustrated by Fig. 17. The smaller set is capable of developing from 25 to 29 horse-power, and the big set from 360 to 420 horse-power. Both engines are built on the Paxman principle of unit cylinders and ventilated crank cases. The injection of the fuel is on the "spring injection" system, and the design of both engines embodies the Paxman-Lentz type of valve gear. The general arrangement of the fuel measuring pumps and governor gear on the large engine are very interesting, and present a very straightforward and simple assembly. The half-tone engraving, Fig. 18, illustrates the general arrangement of the centre column showing the vertical shaft driving the cam shaft, the governor mounting and the arrangement of the control shaft to the fuel pumps.

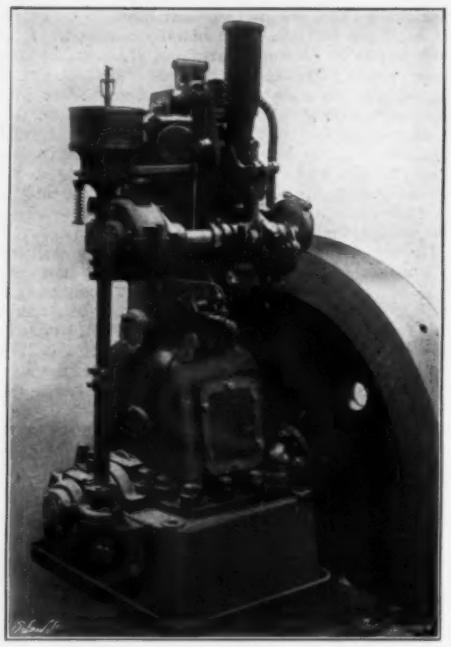


FIG. 16—25 H.P. OIL ENGINE—DAVEY, PAXMAN

Both engines will be stopped and started to show the simplicity of this operation, and attention is drawn to the fact that the engines are shown running under their own power on their ordinary fuel at no load. The extreme evenness of the distribution of the fuel—even when running dead light—to all the cylinders of the large engine serves to demonstrate the benefits to be obtained by having independent fuel pumps to every cylinder, particularly when these fuel pumps and their pipe lines are free from any pressure as is the case with the "spring injection" system. The smooth running of the Paxman engine, to which we have referred in the past, is particularly noticeable, and is due to the combined facts of very careful balancing and machining, the "spring injection" fuel system, and the patented valve gear.

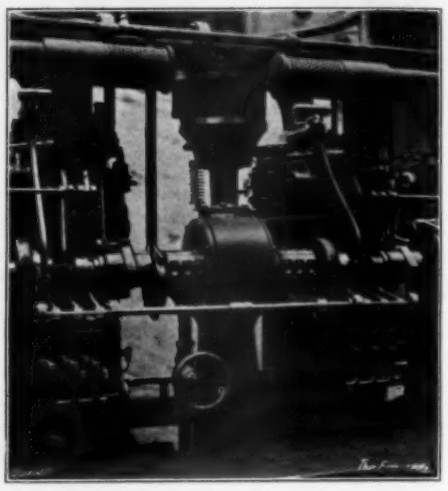


FIG. 18—CENTRE COLUMN OF DAVEY, PAXMAN ENGINE

The larger engine is provided with a platform, and visitors are cordially invited to avail themselves of the opportunity of walking all round and examining the engine in motion. Other separate parts of the engine are also exhibited, including a sectional head completely fitted up with valves and cam shaft, which can be operated by hand to demonstrate the working cycle.

THE WESCO PRODUCTS COMPANY.

An oilcan of rather novel form is being exhibited by the Wesco Products Company, of Birmingham. It is, we believe, the invention of a Canadian rancher. The special feature resides in the pump, which takes the place of the more usual valve, for the delivery of the oil. Although this pump is of extremely simple construction it appears to give a very effective delivery. It comprises two pieces of brass tube sliding one upon the other, with a single inlet valve, operated by a pair of bent springy loops of steel, which give a sudden impetus when they are released. The result is, that although the two tubes of the pump are quite an easy fit, the oil is forced out of the spout with such an impetus that it will travel several feet in the open. The oiler can, nevertheless, be manipulated gently to provide a drop of oil at a time.

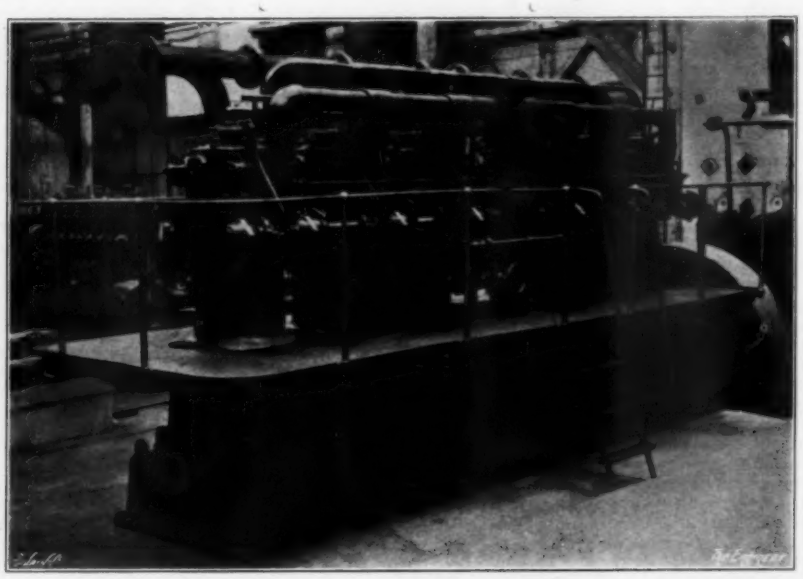


FIG. 17—360-420 H.P. 6-CYLINDER OIL ENGINE—DAVEY, PAXMAN

J. B. STONE AND CO., LTD.

On the stand of J. B. Stone and Co., Ltd., of 135, Finsbury-pavement, London, there are several of the nibbling machines to which we have made reference in the past. The standard types, all of which are

of improved design, are being shown in operation, cutting sheet metal from ⅛in. to 1/16in. thick. This year the firm is showing a new pattern.

The machine is the smallest size now made. It is intended primarily as a bench machine for use when cutting thin stock up to No. 14 gauge. The principle of operation, viz., the punch and die, is the same as in the larger machines. It is specially adapted to small work, such as trimming embossed work, duplicating small parts, template making, small stencil or sign cutting, &c., at a speed of approximately 60in. a minute. This small nibbler is geared directly to a motor which is furnished complete with the machine; therefore, it has the merit of being self-contained, and can be moved from the bench to any convenient position, and then operated from an ordinary lamp socket. All these nibbling machines enable the operator to cut rapidly and most easily any design whatever, interior or exterior, however complicated they may be, the metal showing no deformation or distortion.

THOS. FIRTH AND SONS, LTD.

The stand of Thos. Firth and Sons, Ltd., Sheffield, is devoted, almost entirely, to examples of work carried out in Staybrite steel. We have so often described the qualities of this metal in respect of corrosion resistance that there would be little use in enlarging upon them here. There are, however, one or two developments which are worth mentioning. For one thing, the metal has now been developed to such an extent that a complete range of welded steel tubes is to be put upon the market very shortly, while on the stand there are several examples of joints welded by the blow-pipe. Another direction in which the metal is gaining in favour is for the cast bodies for valves used for controlling the flow of chemical liquids. The specimen which we inspected certainly had a somewhat rough exterior appearance, but there was no indication of blow-holes or porosity. A homely application of the steel is in the manufactory of pen nibs, and is being taken up by Joseph Gillott. We are testing some of these nibs in ordinary service with red ink, but it is too early yet to give the results of our experience.

LIPTAK FURNACE ARCHES, LTD.

There is a new form of furnace wall on the stand of Liptak Furnace Arches, Ltd., 38, Victoria-street, London. One of these walls in course of construction is illustrated in Fig. 20; while the sketch, Fig. 19, shows the details of its construction.

This wall, which is known as the Bigelow suspended wall, has been developed by the manufacturers to meet the difficult requirements for a stronger and more resistant type of wall made necessary by the increasing use of pulverised fuel with the resulting increases in furnace temperatures and wall heights. The method of unit construction and individual suspension takes away from the refractory material all need for carrying the load of the wall, leaving each unit free to expand and contract laterally as well as vertically without imposing strains on adjoining units. This arrangement eliminates the principal causes of cracking and spalling, and gives a greatly increased life, so that the wall will stand up for remarkably long periods under excessive heat and the most violent fluctuations. The method of holding the tile in position is simple and rugged, consisting of a notch in the tile which engages a projecting lip on the supporting casting, as shown in the sketch. This enables any single tile to be removed and replaced without interfering with the remainder of the wall. As shown in the illustration, a single course of ordinary fire-brick is used above and below each horizontal layer of tile. When the two bricks above and below any particular tile are slipped out of place, the tile can be easily removed by simply lifting it up and out of position, so that easy and thoroughly effective repair of those parts of the wall which are subjected to the greatest wear can be effected without disturbing the rest of the structure. No special tools or cements are required and no extensive stock of special parts is needed, since the entire lining is built up from the single shape of tile and ordinary fire-brick. The wall can be placed vertically or sloped to conform to the requirements of special furnace design. It is also possible to provide such openings as may be necessary for the admission of preheated air without resorting to the use of special parts and without decreasing the strength of the wall, and it is rarely necessary to make use of special parts, even for the provision of burner openings where oil or pulverised fuel is used. The amount of steelwork necessary for the supporting structure is remarkably small, and the construction readily adapts itself to the provision of air circulation and the cooling of the supporting structure. The cast iron brackets transmit the heat from the refractories, and so reduce the temperature of the wall and add greatly to the life of the lining.

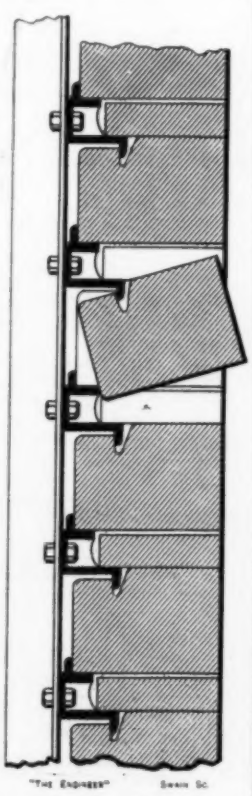


FIG. 19

FIG. 20—BIGELOW FURNACE WALL—LIPTAK

NEGRETTI AND ZAMBRA.

The Eaglwise type of draught gauge shown in Fig. 21 has been introduced by Negretti and Zambra with a view to saving space on an instrument panel or on a boiler front. When many gauges are required, these instruments may be mounted side by side, the cases being constructed so that they fit flush with one another. The cast iron back measures 17in. by 3½in. and four holes are provided for attaching the instrument to the wall. The case is made of sheet iron, and it has a flat glass front. The advantages of the flat glass is that it is more easily replaced than curved glass, and it does not produce distortion or reflection. The curved scale is 14in. long, and it is marked with bold black figures on a white background. The movement is of the metal diaphragm type with diaphragms operating well within their elastic limit. A two-way cock is fitted, and there is an externally operated zero adjustment.

FIG. 21—DRAUGHT GAUGE—NEGRETTI

The new drum type temperature recorder shown in Fig. 22 is another of Negretti and Zambra's exhibits. The case is moisture proof and dust-tight, and it is suitable for wall mounting. As will be gathered from the illustration, the cast iron case has a hinged front, which is held in position against a rubber seating by four wing nuts. The instrument is constructed on the mercury-in-steel principle. Other recording instruments of the drum type are also made, such as recording air pressure gauges, recording draught gauges, and recording barometers. A new type of thermo-couple or resistance recording thermometer has been designed by Negretti and Zambra. The instrument is constructed on very robust lines and the movement is mounted in a cast case which is reasonably fume and water-tight, and is suitable for panel or bench fixing. The horizontal clock drum gives a time scale of ½in. per hour, and a temperature scale of 5in. Inside the case there is a lever for winding the clock which runs for eight days, whilst the drum rotates at the rate of once per day. A high-resistance dead-beat spring-controlled movement is employed. The coil is mounted on double pivots in spring jewelled bearings, and it turns about its own axis in the field of a powerful magnet. The pen arm is pick or "T" ended, one prong indicating the temperature on an engraved scale, while the other marks the chart with inked dots at one-minute intervals. The various operations of the inking mechanism are as follows:—The pen arm is free and indicates the true temperature, but does not touch the chart; (2) the inked pad is brought forward by the clockwork gear until it is between the pen and the chart; (3) the clockwork gear depresses the pen on the pad and then allows the pen to be free; (4) the inked pad is taken back out of the way and the clockwork gear then depresses the pen on to the chart, thus making an inked dot; and

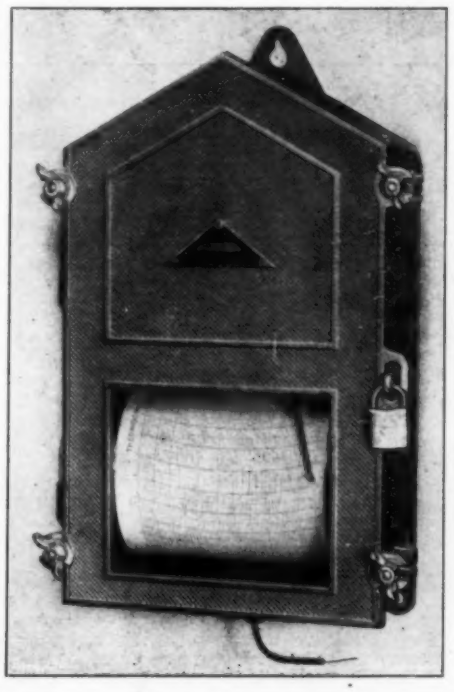


FIG. 22—TEMPERATURE RECORDER—NEGRETTI

(5) the pen arm is free. When it is necessary to record two temperatures, a switch is operated by the clock gear and the second trace is made by two dots instead of one. The two records are said to be readily distinguishable. This method of inking ensures a clear and reliable trace of the temperature without any attention or adjustment beyond the re-inking of the pad with a brush as occasion requires. As the pen arm is free to take up the true temperature position before it is depressed, friction between the pen and chart is avoided. As the weight of the ink picked up by the pen or point from the pad is very small indeed, it introduces no perceptible error. The inked trace on the chart is permanent and the pen or point may be made to give a fine or thick line, as desired. The principle of this inking device is not new, but the clockwork cam mechanism and the arrangement of the movement have undergone considerable modification. The clockwork gear has been designed to give an ample reserve of power for operating the drum cams, and switch contacts. The winding lever, zero adjustment stop and start lever are very accessible. The switchgear is also conveniently placed for cleaning purposes. For the entry of the cables watertight glands are provided, and inside the case there is a terminal panel for wiring purposes. With the object of insulating the movement from vibration, it is mounted on rubber buffers. No special levelling is necessary, the galvanometer being of the double pivoted type.

Super Suctor Sales, Ltd.

The outstanding feature on the stand of Super Suctor Sales, Ltd., 4, Lloyd's-avenue, London, E.C. 3, is the machine illustrated by Fig. 23. This machine has the general appearance of a hack saw, but, by means of some special attachments can also be used for filing, slotting, shaping and broaching. As will be observed from the illustration, the bed is of cylindrical form, and on it there is mounted a saddle which can be moved longitudinally and angularly, so that the work fixed thereon can be cut in almost any direction. The saw arm carriage is supported in transverse vee bearings in the bed, and has a screw adjustment of 4in. controlled by a hand wheel at the operating side of the machine; this adjustment enables the saw to operate laterally in any position from zero to 4in. The revolving box table has four sides to which the work may be clamped directly, or the sides may carry a swivel vice, angle plates, or special fixtures, as desired. The table in the first face has tee slots running in a transverse direction, with a vee slot to accommodate bars between 1½in. and 5½in. diameter. The second face has tee slots running in line with the saw frame, and a vee groove to take bars up to 1½in. diameter. The third face has a centre bolt hole and circular slot to accommodate a swivelling vice; while the fourth face has tapped holes to take angle plates or any special fixtures. The drive is by means of a single pulley and dog clutch and is engaged and disengaged by a lever brought to the saw end of the machine. From this a rod extends along the bed, one end carrying the operating handle and the other the cam. The latter actuates a rod by which means the clutch pulley is moved in and out of engagement. Mounted on the pulley shaft there is a long pinion which meshes with a gear carried on the driving plate shaft in the saw arm carriage. The pinion is of sufficient length to accommodate the travel of the carriage with the driving gear constantly in mesh. The connecting-rod is adjustable, and is fitted with a phosphor bronze brush. By means of a radial slot in the driving plate, the length of the stroke may be varied, and the cutting speed changed from about 30ft. per minute to 2ft. or 3ft. per minute.

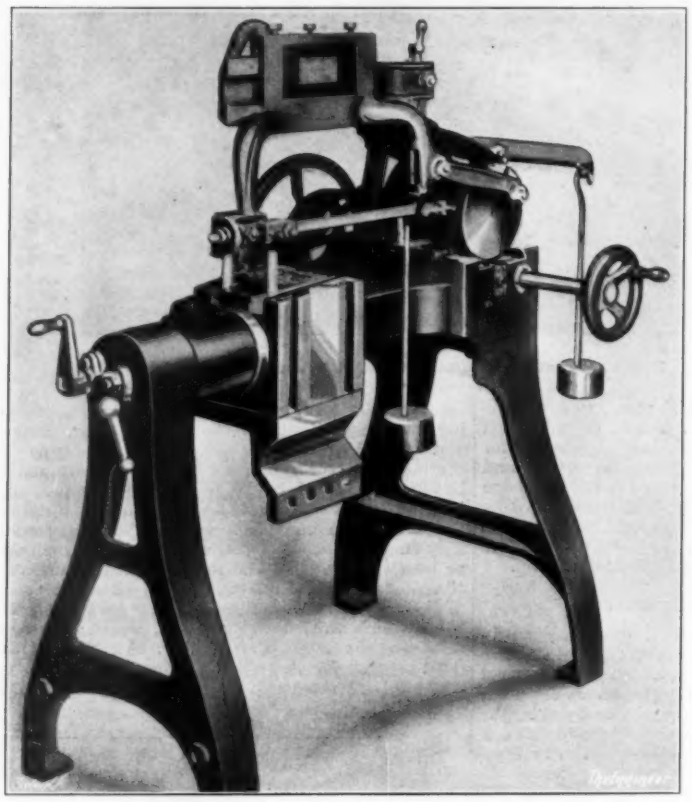


FIG. 23—HACK SAW—SUPER SUCTOR

John Hands and Sons, Ltd.

There are at least a dozen pressing machines of one form or another on the stand of John Hands and Sons, Limited, Belmont-row, Birmingham, and one of them is illustrated by Fig. 24. This press is of the percussion type—that is to say, it is intended to operate the dies by a series of blows—and the stroke is effected by means of a quick-pitch screw. The effect of the blow is naturally rather punishing on the framework of the press, and it has been the custom in the past to reinforce the side columns—made of cast iron—with steel through bolts in tension; but even then failures of the framing sometimes occurred. In the press under review, however, the uprights are of cast steel, and we understand that they have not been known to fail in service. The sliding head and the bed are of cast iron, but are not, of course, subject to tensile stresses like the columns. The operation of this style of press is so familiar as to need little comment. The two discs on the horizontal shaft, which runs continuously, can be brought into contact, either one or the other, with the leather-faced wheel on the top of the pressing screw. One disc performs the working stroke and the other effects the return. The changeover is manipulated by the lever shown near the base of the press, and the gear is so arranged that when the lever is released the slide returns to the top position. It is hardly necessary to explain that as the screw descends its friction wheel traverses the face of the driving disc and consequently finishes its stroke at an increasing speed, and so gives the dies the percussive action that gives rise to the name of the machine.

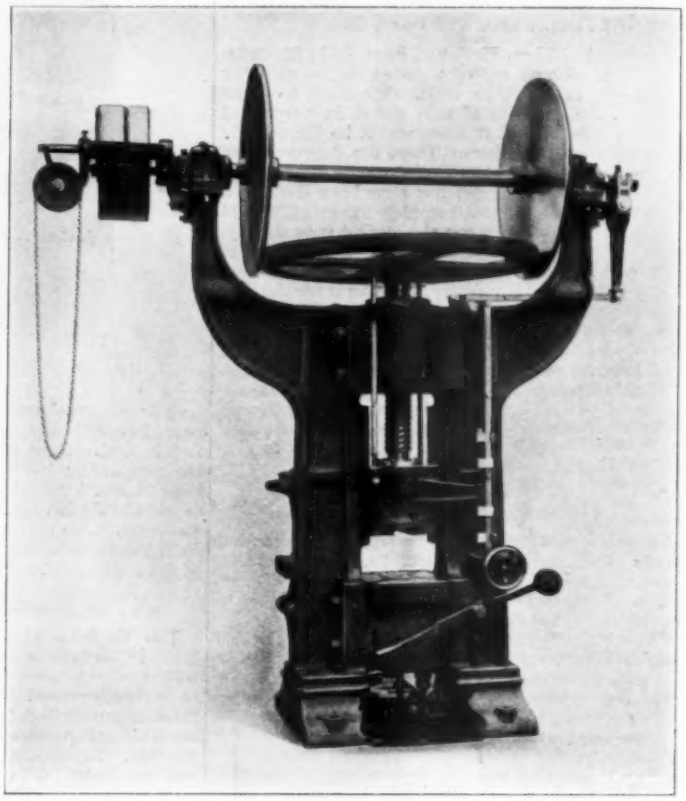


FIG. 24—PERCUSSION PRESS—J. HANDS

The Incandescent Heat Company, Ltd.

One of the principal exhibits on the stand of the Incandescent Heat Company, Ltd., Cornwall-road, Smethwick, Birmingham, is the recuperative, gas-fired furnace illustrated by Fig. 25. The peculiarity of this furnace lies in the fact that it can be started up with a straight-through draught, and quickly brought up to the working temperature, which may be as high as 1200 deg. Cent., and then turned over to recuperative working and a corresponding economy. This system of working is made possible by the provision of two outlet flues and the set of recuperators shown in the drawing below the hearth. When starting up the products of combustion go straight through the furnace and away by the front flue, so that they are only employed in heating up the mass of the furnace proper. When the working temperature has been attained, the dampers in the two flues are reversed and the waste gases are drawn through the recuperators, so that their remaining heat is given up to the incoming secondary air.

The same firm also makes a special form of continuous bright-annealing furnace for individual articles, in which the bed is formed by a series of rollers that are positively driven and so feed the articles forward from the inlet to the outlet. At the inlet end there are two doors, much after the fashion of the air lock used in tunnelling, to minimise the ingress of air, which would produce an oxidising effect within the furnace. At the outlet the articles drop into a tank filled with a mixture of oil and water. The fumes produced by their heat as they drop into

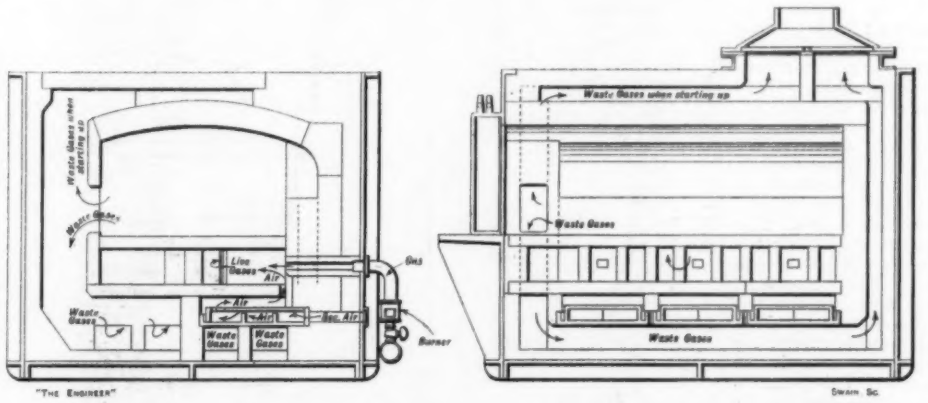


FIG. 25—RECUPERATIVE GAS FURNACE—INCANDESCENT HEAT CO.

the mixture are drawn back through the furnace by the draught and assist in maintaining a reducing atmosphere, and the brightness of the articles being annealed. Some specimens of work on the stand, which have been passed through one of these furnaces, attest their efficiency.

OLDFIELD AND SCHOFIELD COMPANY, LTD.

The lathe is undoubtedly the most adaptable machine tool which we have, and probably next to it comes the shaper, of which one of the most convenient forms we have seen is on the stand of Oldfield and Schofield, Boothtown, Halifax, which is represented in Fig. 26. The peculiarity of this machine is in the various controls, which are all within easy reach from one position, and all of them can be operated while

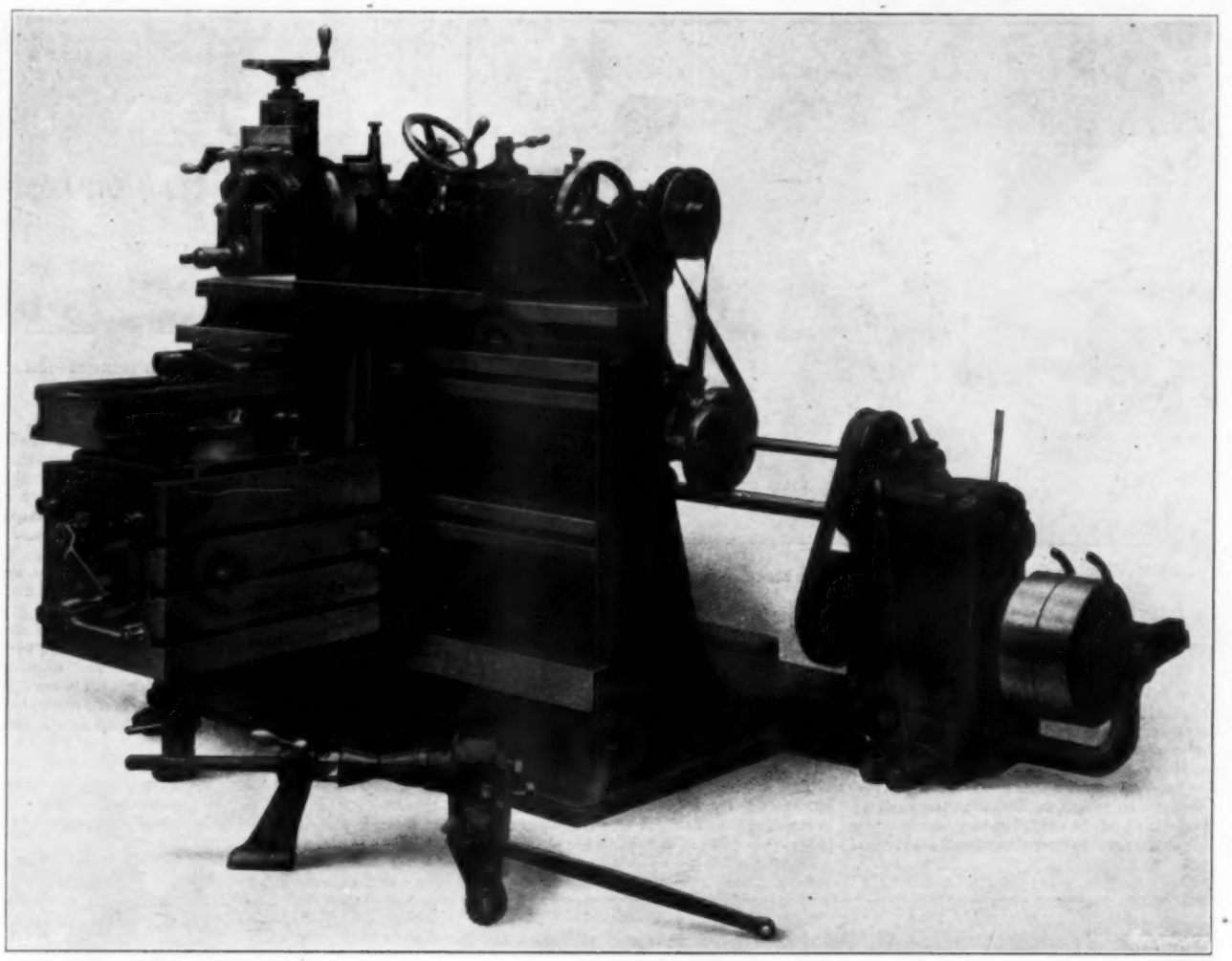


FIG. 26—UNIVERSAL SHAPING MACHINE—OLDFIELD AND SCHOFIELD

the shaper is at work. Thus, for instance, the position of the working stroke can be varied, while the work is continuing from the front to the back of a job by means of the angled hand wheel which can be seen on the side of the tool ram. This hand wheel works a screw in connection with the driving block, and is of such a pitch that it is irreversible, so that once the position of the ram is settled it cannot be displaced except deliberately. The various feeds also can be quite easily changed while the machine is in motion, as they are controlled by crank pins in slides. The pin itself can be fitted into any one of several holes in the driving disc and is then clamped in place by means of a knurled nut. Apart from an unusual dimensional capacity, the machine has such facilities as a mandrel with a rotary feed, so that partially circular work can be shaped up.

There are a number of other machine tools on this stand, but we will confine ourselves to the mention of one other workshop appliance. It is a press for straightening spindles and shafts. The press itself is a comparatively simple affair, with a hand-operated screw-down die. On the table below there are two little stools fitted with anti-friction wheels, on which the spindle to be straightened can be lodged. On the column of the machine there is mounted a dial indicator, reading in one-thousandths of an inch, which is connected by linkwork with a finger directly beneath the pressing die. The process of operation is as follows:—The spindle to be straightened is set on the anti-friction wheels, and is rotated with the finger of the indicator bearing against its lower face. If the spindle is bent the indicator will show the amount of the bend, and its dial is set to zero when the bend is in the upper position. The pressing die is then brought down and the experienced operator knows just how far beyond the median position he must force down the bend to allow for the elastic recovery of the metal. It is, of course, a simple matter to make another effort if the first operation does not properly straighten the spindle. We believe that these machines have become very popular in motor car works for such purposes as straightening valve spindles, and cam shafts, and that a skilled man can turn out truly straight lengths at the rate of about one a second.

MELDRUMS, LTD.

One of the most novel features on the stand of Meldrums, Ltd., Timperley, Manchester, is a fire-door intended for fitting on vertical boilers with the object of mitigating the smoke nuisance when they are fired up. This door stands a little "proud" of the boiler front, and in the projection thus provided at the top there is a transverse opening. Above this opening there is a pipe with a series of steam jets, which, when in operation, produce a strong draught of air over the top of the fire which helps to consume the smoke made when green coal is thrown on to the fire. There is a light damper to close the secondary air inlet when it is not required. There are also on this stand an apparatus for disinfecting clothes by means of steam, and a boiler front fitted with the familiar Meldrum mechanical stoker. In connection with the stoker it is noteworthy that a Sheffield brewery has recently been equipped by this company, and obtains its fuel from an adjacent woodworks, the scrap ends and chips from which are brought into the boiler-house by an overhead pipe.

THOMPSON BROTHERS (BILSTON), LTD.

On the stand of Thompson Brothers (Bilston), Ltd., of Bilston, there is an extensive display of tanks and welded steel plate work including a large steam jacketed pan with a stainless steel interior and an exterior of ¼in. mild steel. The two "bowls," we were told, were welded together at the top lip quite satisfactorily, and then the edge was flanged out to the extent of about a couple of inches to provide a support for the assembly. The merit of being able to weld together a stainless pan and a comparatively cheap steel jacket needs no emphasis, and should be of great benefit to the chemical and catering industries. It was Messrs. Thompson who made the welded steel volute casings for the water turbines at the Bonnington Falls power-house, which were recently described in THE ENGINEER, but such work as that would, of course, be far too large to exhibit at the Fair. This firm also claims to have made the largest galvanising bath in the world. It is 35ft. long by 3ft. 3in. wide and 5ft. 6in. deep. It weighs 23 tons and has a capacity of 125 tons of metal.

MALLETT AND DAY.

A new form of hose coupling, known as the Simcup, for air, water and other fluids, is shown by Mallett and Day, 184, Windsor House, Victoria-street, Westminster. This coupling, illustrated in Fig. 27, depends for its tightness upon the use of a rubber or other washer A, mounted on a circular or hexagonal bush. This bush fits within the bore of the spigot B, and these two parts together are passed within the cup piece C. The end of the second spigot member is shown at D. It is formed with two arcuate projections, the rear edges of which are curved to engage with the cap end, and to cause pressure to be exerted on the rubber washer when the cup is turned. This coupling is claimed to be simple and efficient, and to have many applications in breweries, laundries, dairies, garages,

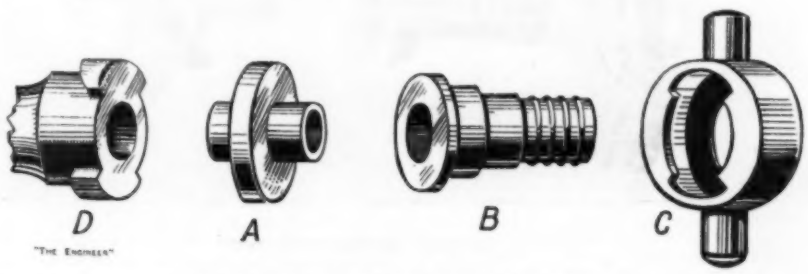


FIG. 27—HOSE COUPLING—MALLETT AND DAY

collieries, quarries and so on. Special washers are provided to suit particular needs.

JOHN FOWLER AND CO. (LEEDS), LTD.

On the stand of John Fowler and Co. (Leeds), Ltd., of Leeds, there are two concrete mixers, a contractor's hoist and some minor appliances of an allied nature. Of these we illustrate, in Fig. 28, the larger of the concrete mixers, which is of the portable type. In connection with its portability, it is noteworthy that the wheels are made of single pressings of steel plate and have all the appearance of being able to withstand the severe usage usually meted out to con-

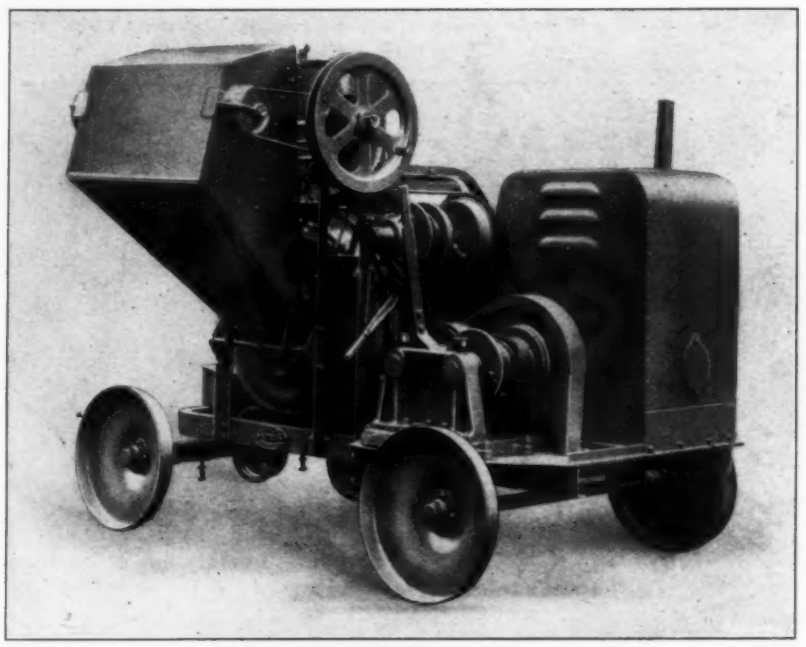


FIG. 28—PORTABLE CONCRETE MIXER—J. FOWLER

tractor's plant. This machine has a capacity of 7 cubic feet of unmixed materials, and will deliver from 5 to 6 cubic yards per hour when the drum is running at a speed of 20 revolutions per minute. It is driven by a 3 H.P. Petter oil engine. There are three other sizes of this mixer, ranging up to 22½ yards per hour in capacity. The general arrangement of this style of concrete mixer is so familiar that its construction does not need elaboration; but it seems appropriate to make some notes on a conversation on its operation which we had with the maker's representative. He had, he said, found some contractors in trouble in using concrete mixers, and discovered that the reason was that they did not add the water to the batch diplomatically. If all the water was added at the start of the mixing, the earlier parts of the subsequent pour would be too sloppy, while the end of the charge would be too dry. If, however, the water was added by degrees, in, say, three doses, during the process of mixing, a uniform quality of concrete could be assured from each mix.

F. WIGGLESWORTH AND CO., LTD.

It is claimed by F. Wigglesworth and Co., Ltd., of Shipley, Yorks., that the "Texrope" drive they exhibit has an efficiency of 98 per cent. The "Texrope" is of more or less truncated triangular cross section, after the fashion of a motor cycle driving belt, and is used in grooved pulleys. It is of cotton with a circular core built up to shape with layers of vulcanised fibre and rubber. The rope is made endless to order, and the makers say that they have such a large stock of vulcanising moulds that it is seldom that they cannot meet requirements. Apart from the obvious smoothness of running which such a drive produces, it has the merit of permitting the driving and driven shafts to be arranged at very close centres without imparing the efficiency. We understand, in fact, that the pulleys can be put almost touching one another, and still a satisfactory drive is obtained. A new form of friction clutch, also shown on this stand, has the merit that it can be very easily dismantled for the renewal of the rubbing faces of the slippers.

CHARLES WINN AND CO., LTD.

The special feature about the screwing machine, illustrated by Fig. 29, which is shown by Charles Winn and Co., Ltd., of Granville-street, Birmingham, is the provision of a pneumatic cylinder for operating

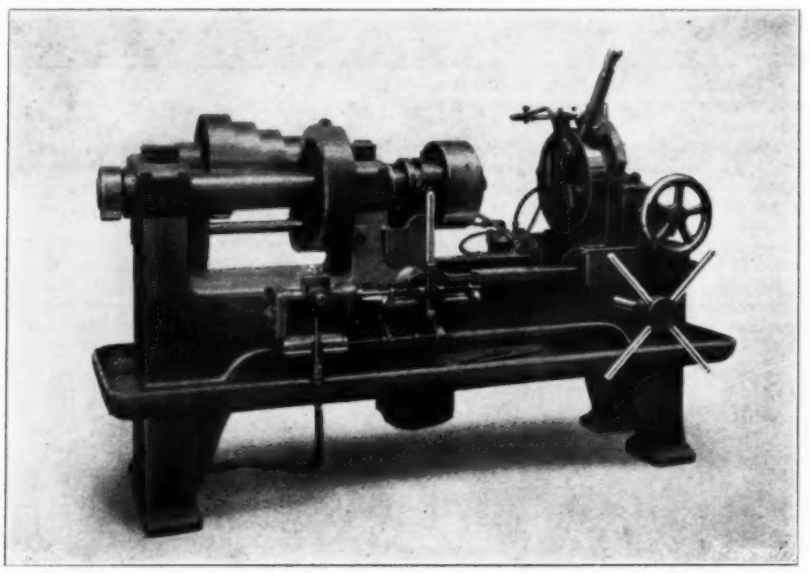


FIG. 29—SCREWING MACHINE—C. WINN

the chuck. This cylinder is connected with the chuck by a forked lever in the manner common in hand-operated chucks and relieves the attendant of a large amount of labour, while it greatly expedites the production of the machine, especially when screwing large work. It is only necessary to open the air cock instead of having to wind up a heavy star wheel to get a good grip on the work. When screwing long pieces this pneumatic device, together with the quick run-back of the die head, is very useful. The machine is made in seven sizes for screwing tubes from ¼in. to 12in. in diameter. On the same stand there are some cutting-off and tapping machines, steam fittings and fire-extinguishing appliances.

HOLDEN AND HUNT.

We have, in connection with the Fair of last year, described the chain-making and welding machinery of Messrs. Holden and Hunt, Cox's-lane Works, Old Hill, and consequently need not enlarge upon the corresponding exhibit this year; but there is on this stand a rather novel piece of apparatus in the form of an electric soldering iron heater, which we illustrate in Fig. 30. There is also the new type of

FIG. 30 SOLDERING IRON HEATER—HOLDEN & HUNT

8-kilowatt spot welder shown in Fig. 31. The soldering iron heater is really a development of the electric rivet-heating machine, and has a capacity of 4 kilowatts. As will be seen from the illustration, there are in the front of the machine two heavy copper electrodes, which can be adjusted in clamps to accommodate different sizes of soldering irons. The upper electrode is fixed in a pivoted frame and can be pressed down by a system of toggle levers, which provide a very powerful grip at the end of the stroke, so that the operator is relieved of any great effort in holding the bit clamped. In view of the high electrical conductivity of an ordinary copper bit, it would be impracticable to heat it directly, so a hole is drilled through the centre and a steel stud screwed in place. The stud is allowed to project slightly on either side, and takes the grip of the electrodes. It

FIG. 31—8-KILOWATT SPOT WELDER—HOLDEN & HUNT

has a comparatively high resistance, quickly becomes hot and its heat is conducted to the copper bit. The current used is at a pressure of from 1 to 2 volts, and will heat up a 1½ lb. soldering bit in about 35 seconds, while one unit of electricity is sufficient to heat such an iron twenty-five times from cold. The transformer is wound for single-phase alternating current, but a connection can, of course, be made across one phase of a two or three-phase system. A plug box, giving three heating speeds, is provided and a switch and fuse are mounted on the back of the machine. The weight of the apparatus is 180 lb., and it can quite conveniently be fixed on the bench. Apart from the convenience of being able to heat up the irons so quickly without there being any smoke or fumes, the system has the advantages that the tinning does not burn off and the bits last much longer than when they are heated in a fire. Although the electrodes are exposed,

there is no danger in handling the machine as the voltage is so low.

GOODWIN, BARSBY AND CO., LTD.

The exhibits on the stand of Goodwin, Barsby and Co., Ltd., Leicester, are principally of interest to builders and contractors, and comprise some stone breakers and concrete mixers, including that illustrated by Fig. 32. The mixer is of the open-drum type, and has a capacity of 7 cubic feet. It is so arranged that it can be loaded and discharged either from the side or the end, and is fitted with a batch measuring bucket and loader. The drum is of riveted steel plate, with a cast iron bottom, which is in one piece with the driving bevel wheel. The drum is supported by a single ball bearing which is so placed as to be kept as free as possible of dirt and grit. When revolving and mixing, the drum is tilted at about 25 deg. so that the blades in its interior do not merely carry the material up and let it fall, but they produce a pouring process, which takes place about 100 times per minute, and ensures a thorough mixing in the least possible time. Both this machine and the smaller one on the stand, which has a capacity of 3½ cubic feet, are driven by their own petrol engines.

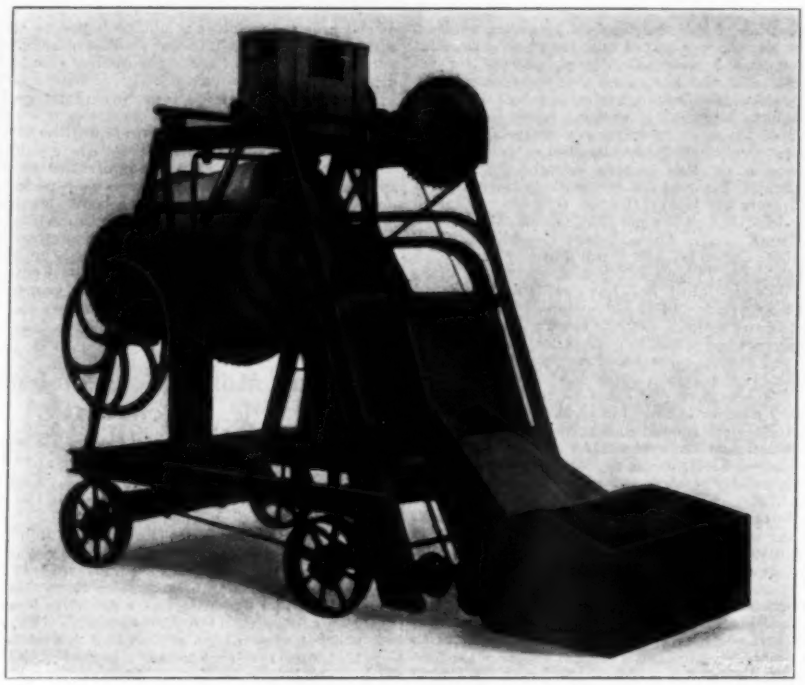


FIG. 32—CONCRETE MIXER—GOODWIN, BARSBY

In the stonebreaker class, only a small portable stonebreaker with screen is being exhibited, but it gives a good general idea of the standard type of crusher made by this firm. A small model of the "Acme" granulator for fine chippings is also exhibited. The chief point in connection with these machines is the fact that they are all made to standard patterns and jigs, thus enabling renewals to be effected in a minimum of time. All the parts have been designed with the idea of making them as simple as possible. A model of the "Jacta" plant for the manufacture of tar and bituminous macadam is also being shown.

G. A. HARVEY AND CO., LTD.

An attractive display of perforated metal work, &c., is shown by G. A. Harvey and Co. (London), Ltd., Woolwich-road, S.E. 7. The art of perforating metals has in this firm's hands reached a very high stage as a single glance at the perforated and embossed radiator guards and similar subjects shown on the stand is sufficient to reveal. To meet the demands for this class of ornamental or art metal work, the firm, we understand, has developed no fewer than 3000 different patterns, a fact which will give some idea of the immense number of punches and dies which it has to have in stock. The designs range from a simple succession of square punchings to a complex punched and embossed rose pattern or one reproducing with much beauty and effect the plaiting of rushes as in an Austrian bent wood chair. Many other examples of perforated metal work are exhibited to meet various ornamental or strictly utilitarian requirements. Among these examples, our attention was particularly called to the perforated cable plates supplied in widths from 4in. up to 24in., and in lengths of from 6ft. to 10ft., for enclosing bunches of electrical cables. These plates are, we understand, now in extensive use in the Navy in place of the familiar wooden casing in which electric light and other wires are commonly housed. The plates are claimed, not only to secure the cables effectively, but by reason of the perforations in them to provide at any point a ready means of leading off a cable from the bunch or leading one into it. Other exhibits on Messrs. Harvey's stand illustrate the extensive range of works and office furniture and equipment in steel which the firm makes. In addition to steel storage bins with fixed or adjustable shelves and divisions, steel shelving and racks, the firm has developed a range of steel workshop offices, such as are provided for foremen, steel tables, clothes lockers, wardrobes, desks, counters, filing cabinets, and so forth.

JAMES WARD (WORCESTER), LTD.

There are two new machines on the stand of James Ward (Worcester), Ltd., Broad-street, Worcester, one of which is a hack saw and the other a hand lever press. The chief peculiarity of the hack sawing machine is the provision of a special guide for keeping the saw in a truly vertical position. It takes the form of a vertical rod of hardened steel with a transverse slot through which the saw is threaded. This rod is arranged within the bow of the saw frame and slides up and down in a hole bored in a fitting bracketted off from the main frame of the machine. The guide comes close up against the back of the piece being sawn off, and consequently prevents the saw from wandering away from a square cut. The saw will, in fact, cut off successive slices of $^1/_{32}$in. thick with no appreciable variation in thickness. The guiding slide for the saw bow is of flat section, and is provided with adjustments to take up wear. In the case of the little hand lever press, there is a rather ingenious arrangement of links, much after the style of a toggle joint, with an abutment controlled by a screw, in such a fashion that when the platen is brought to the bottom, pressing, position, it can be held there with the full pressure on at the expenditure of no effort on the part of the operator. This firm also exhibits some wire-straightening and cutting-off machines, and a self-primer for such pumps as are used for the circulation of suds on machine tools.

F. J. EDWARDS, LTD.

On the stand of F. J. Edwards, Ltd., 406, Euston-road, London, N.W. 1, there are a number of sheet metal working machines, among which one of the most interesting is a new form of shearing machine for comparatively light gauge metal. The object of the makers has been to devise a machine which will cut out sheet metal in, say, steel up to No. 14 gauge, to any marked-out pattern, with a minimum of waste. The two blades of the shear are only an inch or so long and have slightly curved cutting edges. The bottom blade is the one which does the cutting, while that above is carried by an arm reaching out for a distance of 30in., so that a cut can be started in a sheet at that distance from the edge. The bottom blade is pivoted at one end and at the other is connected with a slide reciprocated vertically by an excentric. This excentric runs at about 240 revolutions per minute. The top blade is mounted in a vertical slide, and can be moved up and down by another excentric on the spindle of a hand lever. By these means the two shearing blades can be drawn apart, so that a sheet can be slipped between them for starting a cut in its middle. The cutters have no self-feeding action, so that as soon as the worker stops pushing the sheet forward the cut finishes and it can be run up to a definite corner, while the stationary top blade makes it very convenient to follow round a drawn-out pattern. We tried this machine at the Exhibition, and found that it would cut No. 14 gauge steel readily at the rate of some 10ft. a minute, while the sheet could be steered round a radius of, say, 2in., with a clean cut. Square corners could be made with exactitude by making two starts for the cut.

On the same stand there is another new machine for sheet metal working in what is known in the trade as wheeling and raising. That is to say, it is intended for taking creases, buckles or dents out of all kinds of awkwardly shaped sheet metal work by a process of local rolling. The essential features of the machine are a pair of rolls, one carried by a long overhanging arm and the other supported on a vertical column which can be adjusted for height so as to determine the pressure on the work. Hitherto in such machines the vertical adjustment has been effected by a screw and lever arranged for operation by the foot, and it was necessary to make several movements to bring down the lower roll to release the work. In the new Edwards machine, however, there is an auxiliary release immediately below the bottom roll, which, by means of an excentric action, drops the roll sufficiently to clear the work, but yet insures that when it is reinstated the pre-determined pressure is restored in the one action.

GIBBONS (DUDLEY), LTD.

We have usually found on visiting the stand of Gibbons, Ltd., of Dudley, subject matter for interesting conversation concerning refractory materials, and we were not disappointed on this occasion; but a complete account would occupy too much space here. There are specimens of bricks and tiles in fire-clay, aluminous clay, silica and carborundum, besides a recuperative gas furnace with a carborundum hearth. Among the bricks that are examples of this firm's style of refractory insulating brick which is intended to minimise the loss of heat from furnaces by radiation. These bricks contain an unusually large proportion of imprisoned air, but are, nevertheless, of good crushing strength, being capable of sustaining a load of 1 ton per square inch. Their insulating value may be gauged by the fact that the heat loss through an ordinary uninsulated brick wall, 9in. thick, is of the order of 878 units, with a temperature difference of 1000 deg. Fah.; with the special brick the loss is reduced to 293 units. The makers inform us, in fact, that a saving in lost heat of from 66 to 44 per cent. can be effected by using these bricks, the amount of the loss varying with the thickness of the wall and the proportional economy being greatest with thin walls.

The British Oxygen Company has asked us to point out that through a transposition of illustrations, the drawing which we reproduced on page iii. of our Supplement of February 17th represented a hand-operated cutting machine and not a universal, motor-operated machine, as might be inferred from the text, although that fact would be obvious to anyone acquainted with either of the machines.

(To be continued.)

The Birmingham Carbonisation Conference.

No. II.*

REVIEWING the position at the close of the Conference, it is not putting it too highly to say that it was an even greater success than its promoters anticipated, the curious feature about it being that with each succeeding session—and there were five in all—the discussions became more animated and the information imparted more valuable.

The early portion of the Conference was concerned very largely with the relations between the coke oven industry and the gas industry. Indeed, there are all the signs of a keen competition between the two, both for the sale of gas and coke. This particular matter came into greatest prominence during Wednesday, February 22nd, but the point kept cropping up from time to time. Two papers paid particular attention to this matter, viz., "The General Scope of the Coke Oven Industry," by C. P. Finn and R. Ray, and "Modern Coke Oven Practice," by G. J. Greenfield and G. H. Harrison. The first paper was largely a review of the general position, as will be gathered from the title; but, like the second, it dealt in some degree with the new types of coke ovens that are being built by way of remodelling, at any rate partially, existing works with, in some cases, the ultimate object of a larger installation to carbonise a greater amount of coal at a lower cost. There are also several instances of entirely new plants on virgin ground incorporating the latest labour-saving appliances, knowledge and experience derived from the most modern American and continental practice. Whilst Messrs. Finn and Ray did not enter into close technical detail concerning them, it was pointed out that practically all these new plants are constructed of high-grade silica brick and are intended to be worked at higher temperatures than was the old practice. This, in conjunction with the fact that the new ovens are of greater capacity and though usually narrower, are higher than the average pre-war oven, makes for a greater through-put per oven at a lower operating cost. This greater output, which in some of the new projects exceeds a through-put of 1000 tons of coal daily, is one of the outstanding features of this new cycle of constructional activity. Another feature is that the actual site of some of the larger plants is not at any particular

* No. I. appeared February 24th.

colliery or even at a steel works, the deciding factor apparently being the suitability of the site for the central receipt of raw material from different sources and the disposal of large quantities of gas resulting from the daily carbonisation of such large quantities of coal. It is the problem of the disposal of the coke and gas which is rapidly bringing the coke oven and ordinary gas and coke supply industry into opposition, and there is an implied determination on the part of the former to compete with the latter if arrangements cannot be made for co-operative working.

Messrs. Greenfield and Harrison's paper gave a considerable quantity of constructional detail in regard to modern coke oven plants, and the two papers together were of a decidedly provocative nature in relation to the controversy between the two industries which is gradually getting keener. The point is that, with the increasing size of plants, the problem of disposal of the gas and coke becomes positively embarrassing to the coke oven industry, and these two papers indicate in their details of construction the reasons. As a matter of fact, a serious attempt is being made to form a technical committee to discuss the whole problem of co-operation between the coke oven and gas industries and the suggestion received universal support at the Conference. There are several instances of the purchase of bulk supplies of coke oven gas by gas undertakings in this country, and the latest contract of this nature has been entered into at Sheffield. One of the stumbling blocks hitherto has been the question of continuity of supply of coke oven gas. Recently, however, the coke oven people have been more willing to give such a guarantee. The arrangement at Sheffield is that a very large stock of coal is to be maintained at the coke ovens and that in the case of a national coal stoppage it has been agreed to purchase coal from abroad or from any other possible source in order to maintain the supply of coke oven gas. It has also been agreed that the men working on the plant shall be carefully chosen, men who are not particularly "red" or who would be prepared to join the Gas Workers Union or, it may be, are not union men at all.

A point that brought the coke oven people to their feet was the suggestion by Dr. E. W. Smith, the Hon. Secretary of the Joint Fuel Committee, that the coke oven people cannot expect to have the advantage of the selling organisation and other resources of the gas industry if there is any intention to sell coke oven gas independently of the gas industry, even only in certain cases. The reply was to agree, up to a point, but it was pointed out that unless the coke oven industry is developed on a large scale it will have to fizzle out—and with it the steel industry. The coke oven people frankly state they are not inclined to allow this to happen without a fight, even if it means poaching on what the gas industry might consider its preserves, in the absence of a co-operative arrangement. Stress was laid upon the point that whilst the coke oven industry must be prepared to give guarantees as to continuity of supply, the gas industry must be prepared to take very large volumes of gas from the coke oven plants, running into, say, 5,000,000 cubic feet per day from individual plants. Smaller quantities would not be an economical proposition to the coke ovens, and the idea is that, failing such an undertaking, then the coke oven people will endeavour to sell their gas and coke direct to consumers.

All this is largely a matter of policy, but it is closely bound up with design, because the trend of development in design is such that it attaches considerable importance to the factors appertaining to the disposal of the surplus gaseous and solid products. From what took place at Birmingham it is evident that a strong attempt will be made to come to some working arrangement on this matter.

Another paper of considerable importance read on Wednesday, February 22nd, was by Mr. E. C. Evans, of the National Federation of Iron and Steel Manufacturers, and was evidence that a large sum of money has been and is being spent by the industry upon research. This work has been done by the Federation's Fuel Economy Committee under the chairmanship of Mr. Mannaberg, the object being to investigate the possibilities of increasing fuel efficiency in British iron and steel practice. That Committee was appointed in 1923 and has done a considerable amount of work of a highly technical and detailed character relating to methods of testing, moisture, ash, distribution of coke ash, physical testing of coke, abradability of coke, reactivity, combustibility, and porosity. In this, assistance has been given by the Fuel Research Board and Professor W. A. Bone, F.R.S., the latter in regard to blast-furnace reactions and the former on coke reactivity. Other work is being carried out on individual cokes by Dr. R. V. Wheeler and others. The various committees that have been formed throughout the country to develop this work are assisted by a grant in aid by the Department of Scientific and Industrial Research, and representatives of the Fuel Research Board and the Fuel Economy Committee of the National Federation have been appointed on all committees.

Whilst Mr. Evans gave an interesting outline of the investigations in hand, he states that as yet no definite conclusions can be drawn, but there appears every possibility that the researches in progress, whether of the fundamental character of those on coke reactivity and blast-furnace reactions, or of the more specialistic and empirical type by the various District Coke Research Committees, will, in the near future, be capable of definite correlation with results of operating practice, particulars of which are at present being collated by the Fuel Department of the National Federation of Iron and Steel Manufacturers.

Among the papers read on Thursday, February 23rd, was one on "Gasworks Refractories," by Mr. A. T. Green. It was on all fours with one given by Mr. Green before the Institution of Chemical Engineers in December last, and it again served to focus attention upon certain important fundamental points. The paper was primarily addressed to the gas industry, but it applies, in nearly all respects, equally to other industries using refractory materials. The point constantly being stressed by Mr. Green and others engaged in the refractory materials industry is, that whereas the technology of clay and silica products has progressed considerably during the past decade or so, what is urgently needed is a definition of the actual conditions obtaining in industrial usage. Up to the present, this phase of the work has not received much attention—in fact, it is an exceptionally difficult subject—but a greater realisation of its importance is becoming evident. The fact, as Mr. Green pointed out, that many superior products have failed in specific duties, whereas the so-called inferior material has given comparative success, in the same field of application, has emphasised the necessity for adequate definition of working conditions. It is evident that at the moment refractory materials are not yet amenable to very definite specifications.

The discussion on this lecture brought forth some interesting details. For instance, as regarded silica materials for settings, stress was laid on the fact that the cementing material used for the joints must be of the same substance as the brickwork itself. Again, a case was mentioned in which a setting of silica bricks was put down by a good old-fashioned bricklayer whose guiding principle was to make the setting "bottle-tight" and have as little jointing as possible. This was a complete perversion of the elaborate instructions of the makers, but the setting has lasted for a number of years and is still in good order. On the other hand, a second setting constructed strictly in accordance with the silica brickmakers' instructions gave trouble from the start. Doubts were expressed as to the degree of expansion over a period of time, but an instance was quoted in which retorts grew several inches during the first two months of operation and have remained constant ever since. Whilst, on the one hand, it was urged by several speakers that there should be no clay in the jointing material, Mr. Green himself stated that a little clay can be a positive advantage, but it must not be in excess. Finally, Dr. E. W. Smith quoted some tests of silica bricks which showed remarkably little expansion under tests, as bricks. Incidentally, a strong appeal was made by a brick manufacturer for greater support for the British Refractories Research Association. This appeal was supported by the author, himself engaged with a firm of manufacturers.

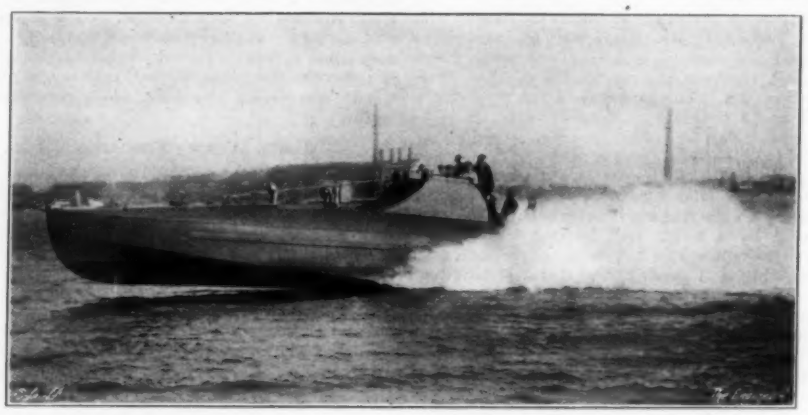
Friday, February 24th, was given up to the consideration of gasworks coke problems and a general review of the low-temperature carbonisation problem. So far as the former was concerned—which occupied the whole of the morning—it largely resolved itself into a plea for the establishment of a central coke sales organisation within the industry by Dr. E. W. Smith, speaking for Sir Arthur Duckham, who is in America. From the purely engineering point of view, perhaps, there is little of interest in it, but from the smoke abatement point of view a distinctly interesting position is arising. It is the fact—although little has been heard of it in public yet—that the coal industry is engaged in organising a co-operative scheme aimed at boosting the use of more raw coal in domestic grates, and the coal industry is prepared to argue that the public will be better off in all ways by so doing than in using the various forms of smokeless fuel in the form of gas, electricity and coke. Here we have apparently a direct incentive to the public to create more and not less smoke, and it will be interesting to see the rejoinder of those concerned with the smoke abatement movement. The effort of the coal industry is the more notable in that again the suggestion has been made that serious steps should be taken—perhaps by the Fuel Research Board—to initiate legislation prohibiting the burning of raw coal.

The discussion on low-temperature carbonisation occupied the whole of the afternoon on Friday and was made the opportunity for giving an outline of the present position. It cannot be said that a great deal of new matter was forthcoming, and we had once more the statements by the Director of Fuel Research (Dr. Lander) that no one system will meet the requirements of all coals, that there are four stages through which every such process must go—laboratory, semi-full scale, full scale, and commercial development—and that some at least of the many processes now being developed are approaching the fourth stage. The representatives of a number of the processes available took the chance of stating their views, but apart from that, the note struck was the great need for careful wording of appeals to the public to invest money in such processes until they have been proved out on a scale involving at least 100 tons per unit of plant per day. One representative on the coke oven side suggested 1000 tons per day, but Dr. Lander thought that was asking too much for one unit at present. A warning was also given to those who may be inclined to think that low-temperature carbonisation processes can be made to pay by the use of low-grade fuel, at present more or less worthless. A reminder was given that the moment the attempt was made to utilise this material the price would soar, as has happened in other directions in the past. Five plants have been tested at the Fuel Research Board—the reports have been published by the Stationery Office—and the general opinion arising partly from the results of those tests and from other information and observations is that there are opportunities for many years for all the processes now available without their interests clashing, provided they can be made to pay. The purely commercial problems were not entered into in any detail, but mention was made of the price at which it might be hoped to sell the solid residue as against coal. Some think a more or less equivalent price for coal of a certain quality should be taken; others believe that an even higher price can be obtained; whilst others argue that a lower price must be charged to induce the household user to change over from coal. It was interesting to hear the representatives of more than one system say that they could sell their solid residue in local mining districts at prices equivalent to coal prices. It is apparent that there still remains a period of steady development to be passed through before low-temperature carbonisation processes will be anything like commonly in commercial use, but one or two systems are already at work in this manner, although necessarily on a small scale.

During the week those attending the Conference paid a visit to the Birmingham Corporation gasworks.

ROYAL DUTCH NAVY, TORPEDO BOAT S.M. 2

JOHN I. THORNYCROFT AND CO., LTD., SOUTHAMPTON, BUILDERS AND ENGINEERS



Coastal Motor Torpedo-boat for the Dutch Navy.

THE Royal Dutch Navy Torpedo Boat "S.M. 2," successfully completed her full power trials at the mouth of the Thames on February 21st, obtaining a speed of just over 39 knots, which is 2 knots in excess of the guaranteed speed. "S.M. 2" is the second of the coastal motor (torpedo) boats ordered by the Royal Dutch Navy from John I. Thornycroft and Co., Ltd., for service in the Dutch East Indies. Her armament includes two 18in. torpedoes, four machine guns, depth charges for anti-submarine work, and facilities for smoke screen work. Her length is 55ft., and she is fitted with two Thornycroft Y/12 type engines, each developing about 400 B.H.P. The first vessel, "S.M. 1," has reached Soerabaya in the Dutch East Indies, and is now being commissioned for service by the Netherlands Colonial Navy there.

B.E.S.A. SPECIFICATIONS.

ELECTRIC POWER SWITCHBOARDS.

A NEW British Standard Specification for electric power switchboards for indoor installations up to and including 33,000 volts has just been published by the British Engineering Standards Association. It relates to switchboards for use with low, medium, high and extra-high voltages, both for direct-current circuits and for alternating-current circuits for frequencies up to and including 100 cycles per second, such as are employed in connection with generating, transforming and converting plant and large motors.

The general clauses include definitions and details of design and construction which are common to switchboards for all voltages. These clauses provide for arrangement of bus-bars, connections with wiring, interchangeability between component parts of similar design and rating, protection of operator, protection against fire, provision of safety devices, interlocks, indicating devices and colouring of signal lamps, remote control, &c. Further sections deal with the requirements, additional to those in the general clauses, for low and medium-voltage and high and extra-high-voltage installations respectively, the latter comprising both cellular and metal-enclosed types. The final section deals with the high-voltage test to be carried out on the completed switchboard. There are two appendices, one indicating the information which should be supplied with the inquiry or order, and the other dealing with recommended slab sizes for slate and marble slabs.

This specification (No. 162, 1928) may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria-street, S.W. 1, price 2s. 2d. post free.

THE Greek official *Gazette* of February 15th published the conditions under which the Greek Government invites foreign tenders for the work of draining the valley of the Struma—the ancient Strymon—and the plains of Cavalla and Thessaly. Firms tendering may put in for all the work or any section of it. It is estimated that the total cost will be approximately thirty million dollars, which will have to be raised by loan, the flotation of which must be undertaken by the firm to which the work is adjudicated. Details of the conditions for tenders have, states the *Gazette*, been communicated to Greek Legations abroad for publication.

Railway Matters.

IT is officially announced that as Mr. V. A. M. Robertson has resigned in order to take up another railway appointment, Mr. T. H. Seaton, the Leeds district engineer, London and North-Eastern Railway, has been transferred to act as Stratford district engineer, in place of Mr. Robertson.

THE express from Hellifield to Manchester (Victoria), which runs in connection with the morning express from Scotland to London by the former Midland route, was derailed near Clitheroe on Monday afternoon last. Although all five coaches, as well as the engine, left the rails, there were no personal injuries.

MENTION was made in this column on January 27th of the benefits received by charities by the exhibition to the public of the "Royal Scot" locomotive. It is now said that 23,066 persons saw the engine the other week, when exhibited at Victoria Station, Manchester, which figure exceeded the record hitherto of 21,605 people at Glasgow.

LEAVE was given, on the 15th February, for a Bill to be introduced to compel railway companies to provide lying-down accommodation in third-class compartments in long-distance trains. The proposal is that there shall be four collapsible bunks in each of such compartments with a pillar and rugs, for which a charge of 5s. extra per passenger may be made. The Bill was read a first time.

LINES built as light railways possess many advantages in the way of economical working; in other words, a light railway may do, or omit to do, certain things contrary to a standard railway. There are thus benefits to be gained by the re-classification of an existing standard line as a light railway. That has just been done, under an order of the Ministry of Transport, on the Easingwold line of the London and North-Eastern.

THE relations between the Metropolitan and the Metropolitan District railways were mentioned at the recent meeting of the former company. Lord Aberconway observed that the District was the only one of the underground railways with which the Metropolitan had a physical connection, and his board had always been prepared to negotiate for its purchase. That had been rendered more difficult now by the District having been included in the proposed scheme for pooling London traffic.

THE purchase by the Government of India of the Peninsula Locomotive Works was referred to herein on December 23rd. Those works were the property of Kerr, Stuart and Co., Ltd., whose report for the year ended in July last mentioned this transaction and said that in November, 1926, the company was informed by the Government of India that owing to the reorganisation of the State railways a surplus of 30,000 wagons had been disclosed, and therefore it would not be possible to place further orders with the company for at least two years, and probably not for five years. In these circumstances the Government offered to buy the works, and that was done, at a price equal to £150,000.

SPEAKING at the annual meeting of the London, Midland and Scottish Railway last Friday, February 24th, the chairman, Sir Josiah Stamp, said that the company's expectations as to the "Royal Scot" engine, both as to its power and economical running, had been exceeded, and that Sir Henry Fowler and his staff were to be congratulated on the great success of their design. The services of the North British Locomotive Company, in both quality of work and promptitude of delivery, also had to be acknowledged. By changing the engines of the 10 a.m. from Euston and of the corresponding up train at Carlisle only three engines of the "Royal Scot" class did the work that formerly required six of the other types.

THE approaching completion of the modernisation of Crewe works was announced at the annual meeting of the London, Midland and Scottish Company. The "belt system," familiar in motor car manufacture, had been introduced into the repair shops. Instead of a locomotive having every successive job done upon it at one spot, the locomotive was taken to the spot where one stage of repairs only was carried on. It is a much more difficult thing to introduce for repairs than for new manufacture and demands, for the best results, a reasonable standardisation of types. The advantages to the company and to the workers have exceeded the officers' expectations. In a forthcoming paper at the Institution of Mechanical Engineers Captain Beames will deal fully with this subject.

A MESSAGE from New York, which appeared in the daily Press about ten days ago, suggested that the Chicago and North-Western Railway was doing something wonderful in equipping its line between Chicago and Omaha with automatic train control. There is little that is voluntary in that work, as all the railways have been compelled, under the Transportation Act, 1900, to install the system. Under the first Order of June 13th, 1922, of the Interstate Commerce Commission the C. and N.W. had to fit it on the 148 miles between Boone and Omaha, and under the second Order of January 14th, 1924, on the 200 miles between Clinton and Boone. What actually is now being done is voluntarily to carry the system on to the terminus at Chicago, a further 138 miles. Moreover, the first Order was completed in January, 1926, and the work under the second Order is in hand and was due for completion a year ago.

THE Italian Government has authorised the expenditure of 7,000,000 lire—approximately £76,000—on general improvement works at Ancona. The harbour, although considered one of the finest on the south-west coast of the Adriatic and one of the best in all Italy, has not been brought completely up to date. It is, therefore, the desire of the Government that the work should be effected without delay, so that the port may be used to a fuller extent for the import of coal, timber, metals, jute, &c., and be able to handle more expeditiously the exports consisting mainly of asphalt and calcium carbide. The railway connection between Bologna and Brindisi, which links Ancona with Rome, *viâ* Fogligno and Orte, will also be extended and improved, electrification of part or whole of the line being suggested. The construction work will be carried out under the supervision of the Ministry of Public Works.

Notes and Memoranda.

THE Government Geologist of South Australia says that the hematite, magnetite and limonite deposits of the Iron Knob and Wyhalla Districts amount to some 150 million tons.

THE explosion of a hydrogen cylinder in a Dutch artificial silk factory is attributed to the use of electrolytic gas and the consequent charging of the cylinder with a mixture of oxygen with the hydrogen.

FOUNDRIES here and there are finding that a quicker and more satisfactory method of graphiting moulds for castings is to use a welding torch with a low-pressure carbonising flame, by which the inside of the mould is very quickly and thoroughly smudged, leaving the surface absolutely dry and well lubricated to produce a smooth casting.

A RECENT article in *Industrial Gases* describes how two conveyor worms 6in. in diameter by 48in. and 30in. long, were formed with an oxy-acetylene blow pipe. The thread of the worm was marked out on the solid bar, and the metal was cut away by the blow pipe in "chunks" of approximately a quarter of the circumference each. The thread was trimmed up to a template and finally machined. It took five hours to rough out the 30in. worm and twenty-three hours to machine it.

AT the last meeting of the Academy of Science in Paris M. Termier announced the discovery of a new dome of salt in Alsace. This discovery was made by MM. C. and M. Schlumberger, who used the electrical prospecting method of which they are the inventors, and which is based on a measurement of the resistance of the strata. This method enabled them to make a similar discovery last year at Mannheim. The deposit now reported is situated near Colmar. Soundings have proved that it rises to within 80 m. of the surface.

IN commenting on the explosion of a 1¼in. gun-metal stop valve in a Scottish paper mill, the Engineer Surveyor-in-Chief says:—"The cover of this small stop valve chest was of a light design and had been so reduced in thickness by machining that it was quite unfit to sustain the somewhat rough usage to which such fittings are often subjected during overhauling and repair operations. Makers of such appliances should remember that though such light scantlings may be strong enough, by calculation, to withstand the pressure of steam, the stress set up when a cover, secured by a fine thread, is screwed up to steam tightness with a powerful spanner has to be provided against and requires considerable thickness at the stressed parts."

AT a meeting held on February 16th, 1928, at the Imperial College of Science and Technology, the President, Dr. R. S. Clay, in the chair, a paper entitled "An Investigation into the Beam from a Standard Lighthouse Lens," was read by W. M. Hampton, Ph.D., B.Sc., F. Inst. P., A.I.C., of Messrs. Chance Brothers and Co., Ltd. In this paper the distribution of light from a third order Fresnel panel was measured, using two different light sources, a standard petroleum vapour burner and a 3 kW lighthouse cruciform lamp. A complete theoretical discussion of the factors affecting beam candle-powers is worked out and tables are provided for the calculation of the beam candle-power from any apparatus using any light source.

THE successful commercial production of synthetic ammonia has resulted in reduced revenue for the gas industry from its by-product sulphate of ammonia; and, partly with a view to recovering some of this loss, attempts are being made to increase the sales of gasworks coke, another by-product. A valuable market is obviously indicated by the urgent need for a cheap smokeless fuel suitable for domestic use, but gasworks coke, although of definite value, is hardly the ideal fuel from the domestic consumer's point of view. The gas industry, however, is well aware of the value of this possible outlet, and a considerable amount of work is being carried out with the object of improving the gasworks coke. Variations in the present methods of carbonising the coal in the gasworks retorts are being considered in this connection, and among them is that of "blending" the coke with gas coal or with non-coking coal.

IN the course of a paper on "The Economic Aspect of Pulverised Fuel Firing," read before the Belfast Association of Engineers, Mr. E. G. Ritchie said that, assuming a plant having a normal total evaporation of 150,000 lb. of steam per hour with 3000 operating hours per annum on a load factor of 60 per cent., the gross yearly evaporation would be 270 million pounds. With stoker firing an annual operating efficiency of 75 per cent. would be considered high, having regard to the fact that banking losses correspond to about 5 per cent. of the total coal consumption. With pulverised coal firing the annual operating efficiency would be about 85 per cent.; 5 per cent. thermal gain while the plant is steaming and 5 per cent. gain from the elimination of banking losses. With coal having a calorific value of 10,000 B.Th.U.'s per pound as received, and assuming that 1000 B.Th.U.'s is absorbed per pound of steam produced, the annual fuel consumption with the two systems of firing would be as follows:—Stoker firing, 16,070 tons; pulverised coal firing, 14,170 tons.

IN order to obtain specific comparative data on the cost of painting by hand and by air spray, a large manufacturing establishment recently painted half a building by one method and half by the other, says the *Compressed Air Magazine*. The surface painted was galvanised iron. The ridge of the roof was the dividing line; and each half had an area of 1111 square feet. The same kind of paint was used in both instances and the labour cost was constant. It took seven hours and 7½ gallons of paint to cover the surface by the spray method—at a cost of 22·60 dollars. In the case of the hand method, it required fourteen hours and five gallons of paint, at a cost of 20·20 dollars. On the face of things it would appear that the saving of 50 per cent. on labour by the spray system was more than discounted by the consumption of 33 per cent. more paint; and, further, it would seem that 2½ gallons of paint were wasted. However, a close examination of the work served to show that none of the paint sprayed on was wasted by spattering, as it was found to be in place and doing effective service as a protective agent.

Miscellanea.

THE Swansea Water Committeee has decided to amend its specifications for water mains so as to include steel pipe, and thus give local firms an opportunity of tendering for their supply.

ARRANGEMENTS have been made by the Agricultural Department of the No. 4 Chungshan University, China, for the manufacture of modern agricultural implements in competition with imported goods.

THE decree in force for probibiting the export of iron scrap from Sweden expired on March 1st. The Swedish College of Commerce and the General Direction of Customs have petitioned the Swedish Government to maintain the decree in force until August 31st.

THE first of a series of reports on the endurance of spring steel plates under the repetition of reversed bending stress, based on experiments, made by the Department of Scientific and Industrial Research, has just been issued and can be obtained from H.M. Stationery Office at the price of 9d.

THERE are, says the *Industrial Australian*, good prospects of the vast deposits of rich iron ore at Yampi Sound, 100 miles north of Derby, Western Australia, being worked with British capital at an early date. Negotiations for the shipment each year of 150,000 tons of ore to Japan are proceeding.

THE aggregate tonnage of vessels launched on the Clyde during January and February constitutes a record for the first two months of the year, the total being 117,762 tons, compared with 93,400 tons in 1921, which was the previous record. For January and February last year the aggregate was only 13,350 tons.

THE famous chain bridge across the river Dee at Berwyn, near Llangollen, the oldest suspension bridge in Great Britain, was recently washed away during floods. This bridge formed Thomas Telford's model for the great suspension bridge over the Menai Straits, which was opened a hundred years ago by the Duke of Wellington, and was acclaimed the largest suspension bridge in the world.

AN institution has been formed with the title of the London and District Engineering Council, with the object of providing facilities for personal contact between employers and workers, to afford opportunities for general discussion and to investigate problems affecting the industry. At a meeting held in Westminster on February 27th, Mr. V. A. Patterson, of Dartford, was elected President.

A NEW concrete wall has now been erected on the riverside from Old Lambeth Bridge to Page-street, one of the scenes of the recent disastrous floods. This wall is 3ft. thick and is erected in front of the existing brick wall. Where the Thames actually burst through, the concrete is 5ft. thick. This is, however, only a temporary measure, as it is intended to widen the road in the near future. In front of the Tate Gallery another concrete wall 2ft. thick has been erected.

RECENTLY telephone communication was established between Sweden and the United States and Cuba. The first conversation exchanged was between the Crown Prince Regent, the Swedish Minister in Washington, and Mr. Kellogg, the United States Secretary of State. The United States Minister in Stockholm then spoke with Mr. Kellogg, and afterwards the two chiefs of the telegraph services conversed together. The conversations from the Royal Palace were very successful.

THE Municipality of Florence, having secured a loan of 100,000,000 lire—approximately £1,087,000—is about to commence a number of public improvements, the most important being an up-to-date drainage system. The programme also includes the construction of houses containing not fewer than 3500 working-men's apartments. A further loan will probably be raised for an improved water supply to overcome the shortage usually experienced during the summer. Fuller details may be obtained from the Podestà di Firenze (Florence) or the Direttore dei Servizi Tecnici, Commune di Firenze, Italy.

THE Manitoba Government has decided to appoint a Provincial Hydro-electric Commission, to take charge of and develop its electric distribution scheme. In preparing the necessary legislation, the Manitoba Government is availing itself of Ontario's successful example, and information is now being sought from the Ontario Commission as to the working of the system. It is also seeking to obtain temporarily the services of some of the officials of the Ontario system, not only to assist in the work of organisation, but in the investigation of the water power resources of the Province which will shortly be undertaken.

WE learn that a contract of a value exceeding £800,000 has been awarded by Imperial Chemical Industries, Ltd., through its associates, Synthetic Ammonia and Nitrate, Ltd., to International Combustion, Ltd., of Kingsway, London, for an extension of the pulverised fuel plant at the electricity works on the north bank of the Tees at Billingham, between Stockton and West Hartlepool. This station will rank as the largest electrical generating plant owned by any individual industrial firm in Great Britain. No less than 20,000 tons of iron and steel structural work is required, and the order for its manufacture and erection has been placed with Dorman, Long and Co., Ltd., of Middlesbrough.

THE Montreal *Star* published the following report in its issue of February 15th:—"The President of the United States Steel Corporation is given as authority for the announcement that the company has decided to establish itself in Canada and to build factories for the Canadian market and for export." It is said that the proposals cover all lines made by steel companies now operating in Canada, and that the pay roll will include some thousands of employees. Circles in close touch with the President state that this move has been long contemplated, but has been held up in expectation that the Canadian tariff would be amended with a view to better protection. Now, however, the company is to begin operations with conditions as they are. Preliminary work will be undertaken immediately with the establishment of a factory at Ojibway, near Windsor, Ontario.

15-TON ELECTRO-HYDRAULIC INGOT CASTING CRANE

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, ENGINEERS

(*For description see page* 244)

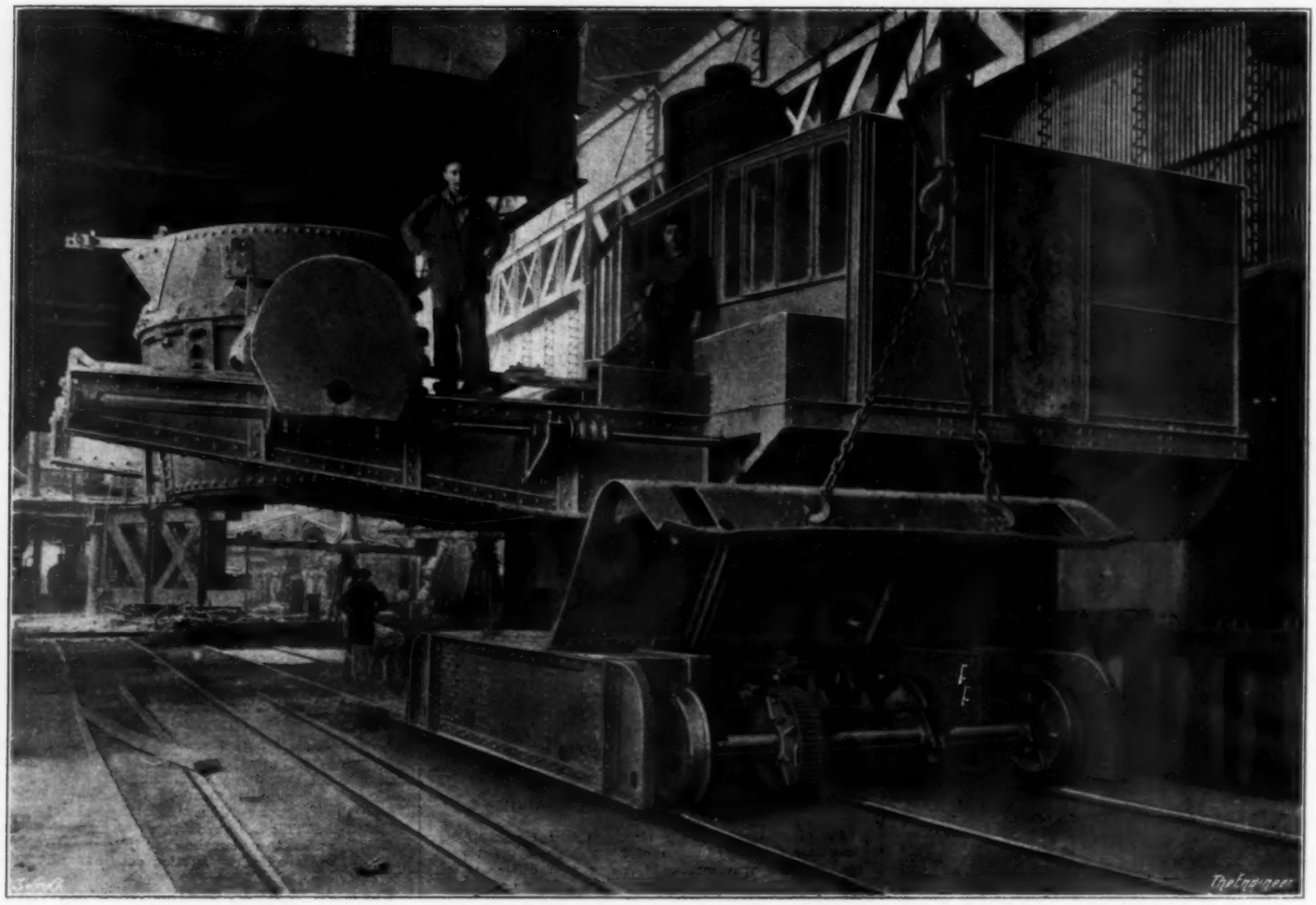


FIG. 1—COVER RAISED TO SHOW TRAVELLING MECHANISM

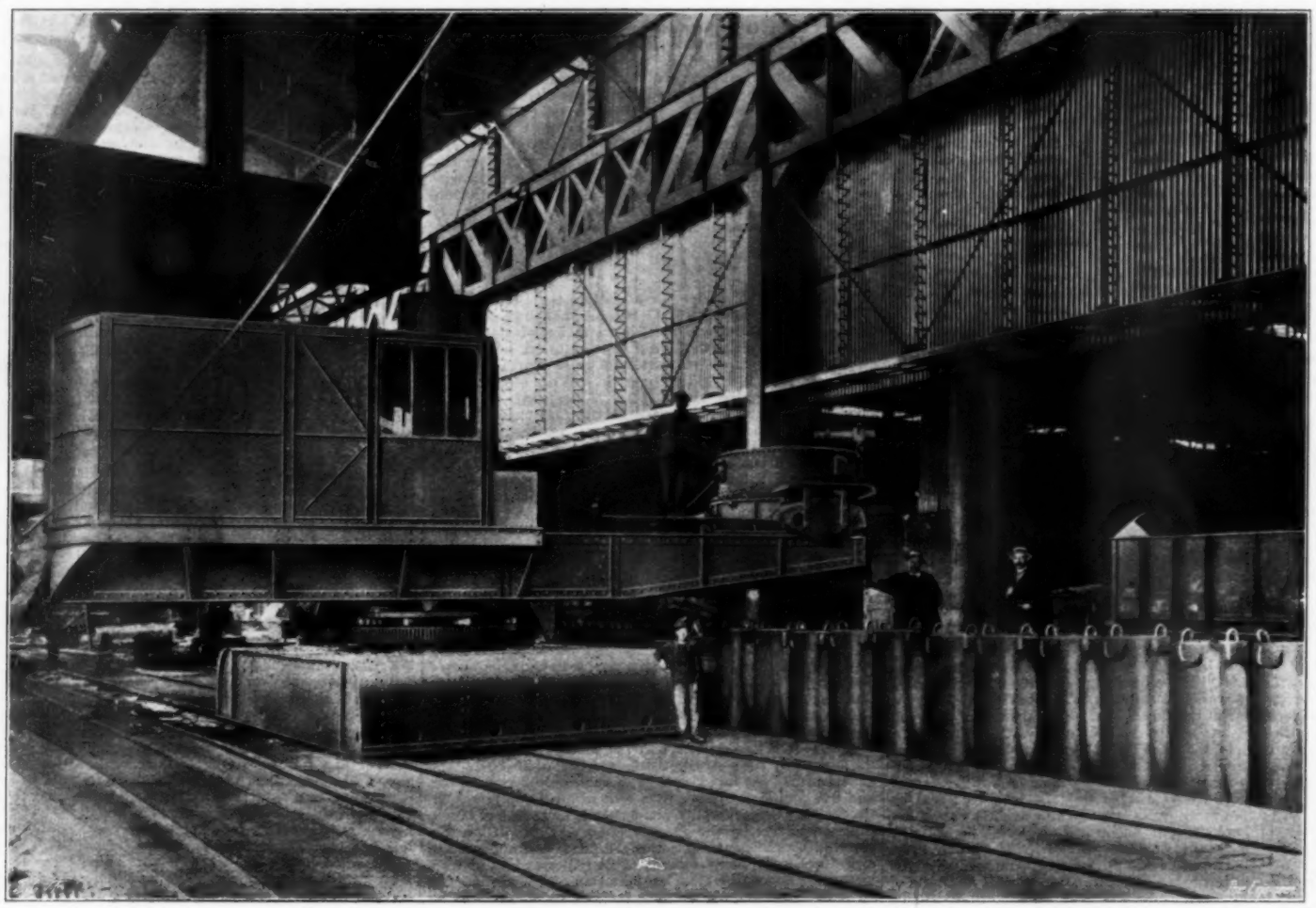


FIG. 2—CRANE IN POSITION OVER INGOT PIT

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THE ENGINEER.

MARCH 2, 1928.

The Heavy-Oil Engine and Electricity Supply.

NEARLY six years ago the Committee of the Diesel Engine Users' Association set itself the task of gathering annually from its members authentic information as to the running and maintaining in service of heavy-oil engines. In the first two or three years the main results recorded related to the operation of air injection oil engines of comparatively small output, designed to run at slow or medium speeds. More recently the scope of the investigation has been widened, and the report presented and discussed on Friday last, February 24th, to which reference is made elsewhere in to-day's columns, may be said to be thoroughly representative of up-to-date heavy-oil engine practice. Included in last year's returns are particulars of the performance of open and enclosed types of air injection engines, both of the four-stroke and two-stroke types, as well as opposed-piston engines, ex-submarine motors, airless injection engines of the open and enclosed types, and surface ignition engines. The returns for last year's working embrace fifty-three stations, of which forty-one are home stations and twelve overseas stations, numbers almost twice those of four years ago. Last year it was possible, for the first time, to place on record the average engine costs of several stations taken over five years. Useful as these averages may be, an examination of the tabulated results shows that owing to various factors there are many stations in which better results than the average are being recorded. It seems to be quite likely that with a further increase in the number of stations reported upon and the introduction of new types of engine, it may be possible to extract even more useful averages by grouping stations into different categories according to their size, the load conditions, and the type of installed plant. Meanwhile, the information presented in the new report is really useful, and is such as to have an important bearing on the question of the use of heavy-oil engines for peak and base load purposes discussed by a correspondent in an article entitled " The Uses of Diesel Engines for Peak Load Supply," which appeared in our issue of January 20th, and which has evoked a vigorous correspondence.

At the outset it should be stated that the investigation into the working costs of oil engines to which we have referred was primarily undertaken with the object of obtaining reliable data as to the expenses connected with the running of engines, and their maintenance in service. The returns only include such items as the cost of fuel and lubricating oil, stores and water, running wages, repairs and maintenance charges. Expenses such as interest on capital, cost, depreciation, insurance and repairs to the electrical machinery driven by the engine are definitely excluded from the scope of the inquiry. In the figures which are given no attempt has been made to make too high claims for the oil engine, but rather it has been sought to bring out its true capabilities as a producer of electric power. According to our reading of the new returns, two important facts are outstanding, first, the reliability of the oil engine driven generating unit, whether as a producer of alternating or direct-current supply, and, secondly, the unimpaired efficiency of the older engines. Some of the running hours are remarkable. If we take the case of a public electric supply station overseas, we find that out of eight engines, all of which except one are over eleven years old, each was run for a period of upwards of 3000 hours per annum. In the case of an 80 B.H.P. engine in one of the smaller stations which was installed nearly twenty-one years ago, the set was run for a total of 4704 hours in the year, with a very good fuel consumption, averaging 0·73 lb. of oil per unit generated. In a list of forty-six installations for which engine particulars are specially given, over 3000 hours were run per engine in six stations, over 2000 hours in a further twenty stations, and over 1500 hours in another ten stations. In all cases the older engines have been operated with efficient results and even after periods of from fourteen to twenty years they seem to be quite capable of giving still further service for several years. One speaker on Friday expressed the opinion that there was evidence that a modern oil engine would have an even longer life than many of the modern high-pressure steam plants which are now being put down. It is interesting to follow the manner in which the total engine cost per unit of electricity generated is split up among the various factors, and some informative figures are given in the report concerning this matter. An analysis of the figure of 0·713 pence per unit generated, which is the average cost for the year for the forty-one home stations, shows that not quite 50 per cent. of the cost goes in fuel oil. A little over 9 per cent. is spent on lubricating oil, and charges for cooling water, including its treatment, along with stores, are represented by close upon 3 per cent. Of the remainder, the wages of the running staff take about 23 per cent., while repairs and maintenance represent 15 per cent. During the past year there was a fall of a little over 10 per cent. in the average engine cost per unit of the home stations. That improvement is to be traced, we gather, partly to lower average fuel prices but mainly to an increase in the capacity and output of the stations from which returns were made. If the working costs over the last five years be taken into account there has been a reduction in the cost of repairs. It is too early yet, in the opinion of the Committee, to assess an average value for the cost of repairs per rated kilowatt-hour run, and the exact influence on the costs of the annual plant load factor, the running plant load factor, and the service factor has yet to be determined. It is reassuring to observe, however, that the average figure of 0·107 pence per unit generated for repairs and maintenance cost is below the figure of 0·113 pence which has been arrived at by the National Electric Light Association of America. There seems to be every hope that in future years it will be possible to extract information as to the life of important oil engine parts before replacement or repair is required.

The evidence of the report all points to the fact that electricity is being generated with increasing economy, both in oil engine driven stations at home and overseas. After the pioneer work on oil engine station operation which has been done by members of the Diesel Users' Association, who have co-operated closely with British oil engine builders in order to obtain the best results, it is with great regret that we learn that some members of this body, including Mr. Percy Still, one of its honorary secretaries, will at the end of this year cease technically to be Diesel engine users on account of their oil engine plant being closed down and bulk supply taken under the provisions of the national scheme. Is it not

possible, we would ask, for the existing admittedly economical oil engine plants to be utilised at least for peak load purposes, so that any additional load which is imposed on the transmission network at such times may as far as possible be dealt with locally? Apart from such possible uses of the existing plants, there is room, we think, for large oil engine operated peak load stations at certain points in the supply area, while equal effective use of oil engine plant could be made on house and peak load service supplies for some of the proposed capital stations. An example of such practice may be cited from Berlin, where it is found profitable to install two 7500-kW oil engine driven sets in a large steam station using brown coal at a little over 2s. 6d. per ton. By using the oil engine sets to take the peak loads, the load factor of that station is to be increased some 10 per cent. With fuel oil at £6 10s. per ton, current will be generated at ⅞d. per unit, and the sets will, we understand, pay for themselves in five years. We understand that the Central Electricity Board has had placed before it by a prominent firm of consulting engineers plans for a 21,000-kW oil engine driven peak load station. It is proposed to install three 7500-kW sets in this station, but when tenders were called for it was not found possible to put forward British-built engines, as our oil engine makers could not offer such large units. Engines of continental design had therefore to be included in the scheme. Is it not largely owing to the successful operation of oil engines in electric power stations, we would ask, that it has been possible in recent years to increase the size and output of engines built in this country? A few years ago the largest engine was only a few hundred horse-power, but last year sets of 1000 B.H.P. and 1750 B.H.P. were put into commission. If, then, further progress is to be made and units of ten times this power to be constructed, British oil engine builders must count on the continued support of the electrical supply industries.

Opponents of the further development of oil engine driven plant have in the past often based their objections to an increased use of this special form of prime mover, on the fact that Great Britain is essentially a coal-producing and not an oil-producing country. It should be borne in mind, however, that the total amount of fuel oil which is required to meet the demands of the engines in power stations is comparatively small, and can be quite well dealt with by a few tankers. That supplies are still plentiful is seen from the slight fall in fuel oil prices during last year. A more important point, however, to bear in mind is the steady advance which is now being made in the direction of the scientific extraction of oil from coal, and the production of fuel oils as by-products in cracking processes. The fuel oils produced by the newer processes of low-temperature carbonisation show a better engine performance than did the tar oils utilised in many stations during the war period, and it seems to be very likely that small supplies of home-produced oil fuels will be available at no distant date, and that they will increase. Should such oils become available, the oil engine will take an important place in any scheme for the conservation of our fuel supplies, and in considering such schemes engineers will do well to consult the valuable information on heavy-oil engine operation which is contained in the papers read before, and the reports on working costs prepared by, the Diesel Engine Users' Association.

The Place of the Workshop in Education.

In the early days of mechanical engineering there was only one way of producing engineers. There were no colleges, few books, no evening classes, and no lectures. The engineer was the product of the factory or the workshop. He was not made; he occurred. Here and there mechanics with greater intelligence than their fellows took the lead by inventiveness or enterprise. They became leaders of industry. Their knowledge of mechanical engineering and of mechanisms was considerable. They were scientific without being scientists. By careful observation—which is the root of science—they discovered defects and removed them, or found out improvements and promoted them. Watt we need not mention; he stands in a class by himself. But Murdock, Trevithick, Maudslay, Rastrick, Hackworth are examples of men who were engineers because they were first-rate mechanics. If any one of them were living at this day he would still be eminent—if education had not spoiled him. They had the engineering instinct. They *felt* when a thing was right. Given their materials, their workshop methods, their general conditions, it is not improbable that an engineer of to-day, with all the advantages of science, would find little or nothing that he could change with advantage in their products. They foresaw things which only in a later year was it possible to realise. The advantages of high-pressure and superheating were known to Trevithick, and the work of Jacob Perkins is to-day, after a lapse of many years, returning to us.

Has mechanical engineering changed radically since the days of the pioneers? That is a question to which a diversity of answers will be given. Omitting the consideration of workshop methods—which are a means to an end, not an end in itself—mechanical engineering is, and must ever remain, the art of constructing machines. That is what it always was. It has not changed at all. What has changed is the nature of the processes which the machines are destined to carry out or perform. The steam turbine, the high-pressure engine, the air compressor, the oil engine, all have inherent problems which are proper to them; problems which can be solved on paper by the scientist and mathematician. But the design of the machines to carry out the requirements of the scientist and mathematician, the proportioning of the parts, the selection of materials, and, finally, the actual mechanical construction in the workshops is the function of the mechanical engineer. Hence it comes about that mechanical engineers—within this limitation of the term—far outnumber the scientists and mathematicians. It is but a small, a very small proportion, of those who are engaged as leaders in engineering factories that have to use any mathematics at all. What they have to employ is the workshop and mechanical engineering sense. A slightly larger number use simple arithmetic, and a few, a very few indeed, employ fairly high mathematics. Of engineers who remain in factory life the first need of the vast majority is the workshop sense. They must know, almost by instinct, the fitness of things; they must see rapidly what can be done and what cannot, and they must be able to tell, almost at a glance, the best way of doing it. No training outside the shops can given them that sense. It cannot be acquired in schools and colleges, for it is the fruit of experience. To a few men it comes almost as a gift; they are the born engineers. By most it has to be acquired by years of intimacy with workshop problems. The man who lacks it makes grave mistakes. We have known expert designers who, because they had never been trained in the works, made drawings of machines which could not be produced; and we have known others who with nothing but their intimacy with machines and methods to help them would draw a workable sketch with the butt end of a pencil on the back of an envelope. There is growing up, with increasing vigour, a school of thought which holds that the workshop training of young engineers is no longer necessary. They concentrate their attention on the manual work done in the works, and say that it is wasted labour. We are far from agreeing with them even on that point; but it is an unessential one. What is essential is the acquisition of the workshop sense, which obviously must be acquired in the atmosphere of the workshop. It is impossible to define it briefly; but every mechanical engineer knows what it is, for he has it in his bones. It cannot be replaced by the higher mathematics or college courses in economics. It must be learnt by daily and hourly contact with materials, machines, and *men*. There is no other way. Even the mishaps of the workshop give instruction and the practical failure of a design may be—indeed, it always is—a liberal education. From the daily trials and difficulties, be they mechanical or human, there is always much to be learnt that no one can teach.

It is unfortunate that support is being given to the "no-apprenticeship" school of thought—in America as much as in this country—by employers, frequently not engineers themselves, who take the best students from colleges and universities at salaries which are too attractive to be resisted. They go at once into specialised vocations and have little or no chance of ever becoming complete engineers. The profession is thereby robbed of some of its most promising recruits. But if certain branches of industry do really need such men; if they would not be better served by men who had had a few years' practical workshop training, as well, of course, as their college education, then it may be necessary to adopt special means for producing them. Yet of this we are convinced, that no full mechanical engineer has ever been or ever will be made without workshop training, and it will be an ill day for that great industry if "apprenticeship" ceases to be regarded as an essential part of the training of young engineers. Whitworth knew what was wanted, and the methods adumbrated by his famous scholarships have never been surpassed as the means of producing full mechanical engineers.

Literature.

The Theory of Emulsions and their Technical Treatment. By WILLIAM CLAYTON, D.Sc., F.I.C. Second edition. London: J. and A. Churchill. 1928. Price 15s. net.

Ever since atoms and molecules became of importance to science in general, a keen interest has been displayed in what happens to matter with increasingly fine subdivision in the case of liquids and solids and to gases with diminution of pressure. Modern colloid chemistry deals with solids in such a finely divided state that, when dispersed in a liquid, they present the appearance of a solution, which, for the sake of definition, is called a "sol." When the dispersing medium is water the term hydrosol is applied. Dr. Clayton gives us in his book a theory of stabile emulsions parallel to that of hydrosols in general. He defines an emulsion as a system containing two liquid phases, one dispersed as globules in the other, and he mentions that the system is reversible, viz., we can, for instance, have one emulsion of oil in water and another of water in oil. The former class of emulsion is, of course, of the greatest importance. In such an emulsion the oil globules are electrically charged by adsorption of ionic charges from dissociated molecules of the dispersing medium. If negative charges are adsorbed, then the positive ions corresponding form a Helmholz double layer surrounding the globule, thus making the emulsion, as such, apparently electrically inert. Part of the charge is, however, effective, and prevents the globules from running together by inter-facial tension. These effective charges are supposed to be constant for each globule, and on their value, which can be determined, depends the maximum size of the globules, which, in its turn, belongs to the order of magnitude of 10^{-4} or 10^{-5} cm. as a diameter, when charge and inter-facial tension balance each other. This development of Helmholz theory is somewhat obscure, but the "give" of the electric double layer explains the cataphoresis phenomena, which in their turn give figures which agree with experiment, from which reason it is an advance *faute de mieux*. The author gives the story in a clear simple way, and goes on to the Brownian movement of very small oil globules, to conditions for stability of oil emulsions, and critical potentials. So far, the emulsions treated are dilute ones without emulsifying agents. Then follow soluble emulsifiers, and finely divided, insoluble solids acting in a similar way for producing more concentrated emulsions. Notes on emulsifiability and "demulsibility" of oils as measurable quantities come next, with some physical properties, viz., colour, electrical conductivity and viscosity of oils to follow. The author is not very particular in making the constants in his formulæ mean the same as in the text. On page 41, for instance, the formula for the sp. electrical conductivity of an emulsion as a function of that of the continuous phase and of the concentration C of the dispersed phase, expresses C as part of the *whole* volume, which makes the conductivity $k = \pm 0$, when $C = 1$. Later on he speaks about C up to 62 per cent! With regard to the viscosity of emulsions, the author says that our knowledge on the subject is far from satisfactory from a quantitative point of view, and everybody must agree with him, as viscosity, or rather apparent viscosity of mixtures, is dependent upon more factors than inner friction.

The further arrangement of the theoretical part of the book, after an interspersed discussion of older theories, involves a number of detailed chapters on the various notions discussed above. It is all very interesting and remarkably exhaustive considering the small size of the volume, and that some space is devoted to practical applications and to methods of mensuration of emulsions. Of these, there are methods for measuring surface tension and inter-facial tension, turbidity and size frequency. The Du Noüy tensio-meter, measuring the energy used in tearing a wire ring from the surface of a liquid or through the contact surface between two liquids by means of a torsion balance is a handy instrument. On the other hand, the capillary rise method is treated without reference to Dallwitz-Wegener's parallel plate instrument, which so far seems to be the only practically useful one for a number of tests in succession, as it can be easily cleaned. For inter-facial tension Donnan's drop ascension method is described, amongst others. Methods of determining which is the continuous and which is the dispersed phase are also discussed, &c. &c. The chapter on rate of "sedimentation," or creaming and size frequency, could be with advantage expanded and the experimental methods described in detail.

This theoretical part forms the bulk of the book, and we may agree with Professor Donnan in the

Foreword that it is excellent, but with a certain amount of reservation. The book shows unmistakeable signs of being compiled from the author's own brief notes, and it exhibits great anxiety on his part to get in as much as possible in a given space. His system of notation is not uniform. V stands for potential difference in one place, for volume in another; *k* for dielectric constant and specific conductivity; &c. &c. Many equations could do with putting into a final shape, and on the whole the book could stand polishing up for the use of students and others mentioned by Professor Donnan. Still, there is the making of a classic in this part, and it is no mean thing for a man like the author, with probably exacting duties to occupy his time, to have produced this compilation. Contrary to expectation, the practical part is meagre in the extreme. No design of emulsifier or churn is illustrated, only the homogenising valve for making emulsions finer. There is under the heading "Colloid Mills" a short description of the "Premier" mill of 1926. This machine is a centrifugal mill in which colloid and dispersing medium pass between a rotating disc and a stationary one from a central feed by centrifugal action. That the identical principle was patented by de Laval prior to 1892 when he brought his "centrifugal emulsor" on the market, seems to have escaped the author's attention, although he describes and illustrates an improvement of the same inventor's milk separator—which was not his—as a compensation. The great field for emulsions in pharmacy and photography is not even touched, in spite of its ever-growing importance and of the fact that standard methods of manufacture are used. Some applications of cataphoresis and chemical breaking of emulsions are given, and a separate paper by Ramsden on "The Theory of Emulsions Stabilised by Solid Particles" is added as an appendix.

As an early attempt to treat this highly important subject in a collective form, this book is no doubt welcome to a great many, and the appearance of a second edition proves this; but we would like to see it revised and amplified in a probable future issue.

Applied Heat. Adapted from "Der Wärmeingenieur," by Dipl. Ing. Julius Oelschläger. Under the Editorship of H. Moss, D.Sc. London and Glasgow: Blackie and Son. 1927. Price 30s. net.

To give an idea of the nature of this book it is almost sufficient to say that the ground covered is wide enough to justify the comprehensiveness of the title, and that the whole is dealt with in the course of 328 pages. If from this space we subtract that occupied by 267 illustrations and diagrams, it will be evident how cursory the general treatment must be. The author has certainly performed a feat of compression, but whether it was worth doing is another question. The general principles of thermodynamics are disposed of in 24 pages, of which about eight are given up to tables concerning the properties of various substances. Fuels and their combustion are discussed in a chapter of equal length. In the next two chapters, together comprising 110 pages, the reader is informed about cupolas, lime kilns, boilers, mechanical stokers, pulverised fuel firing, cement kilns, destructors, metallurgical furnaces of various kinds, waste heat boilers, gasworks retorts, coke ovens and gas producers. Even boilers for domestic heating are included. Power station boilers are dealt with more especially in the next chapter on "Heat for Heating Purposes," but before coming to them we are given information on blast-furnaces, cupolas, glass furnaces, brick and pottery kilns. Space is even found for about 11 pages on domestic heating by means of open fires, stoves and radiators. Steam boilers, in the engineer's sense of the word, are depicted in 17 illustrations, ranging from a type suitable for a steam wagon to one designed for an evaporation of 100,000 lb. per hour. Electric boilers are given two further illustrations. The whole subject of refrigeration gets eight pages.

"The Utilisation of Heat for Power Purposes" has a chapter of 39 pages all to itself. Within this compass, reciprocating steam engines, turbines, gas engines, heavy oil engines, motor car engines, aeroplane engines, and even the Pulsometer pump and the Humphrey gas pump are all given as much attention as so much compression permits. Steam accumulators, condensing plant of various types, cooling towers and distillation plants form the subject matter of a chapter of 18 pages, while to make the work really complete a final chapter of 34 pages deals with the heat balance of plants; the methods of measuring solid and liquid fuel supply; metering the flow of steam, air, gas and water; measurements of pressure and temperature; of calorific value, of indicated and brake horse-power, and the analysis of gases.

One could fairly say of such a book that no person concerned with any industrial application of heat could fail to find in it something interesting to him. The question, however, is rather whether he could find enough information on any subject to be of practical use. The reader reaches the last page with something of the sensations which must be experienced by a tourist returning from a fortnight's personally conducted trip through all the capitals of Europe. However capable the guide, the result could only be an attack of mental indigestion. A little knowledge may or may not be a dangerous thing, but one would have to drink much more deeply at the "Pierian Spring," than the present book permits, to quench even a moderate thirst. The translator has done his part well, and has even taken the unnecessary pains to use the Fahrenheit scale of temperature throughout. Nevertheless, we cannot help regretting that his ability was not exercised on one of the many German works of more real value to engineers.

BOOKS RECEIVED.

The Principles of Electric Power Transmission by Alternating-currents. By H. Waddicor. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 21s. net.

Annales des Ponts et Chaussées. 1927. No. VI. Novembre-Decembre. (1) *Partie Technique;* (2) *Partie Administrative.* Paris: A. Dumas, 6, Rue de la Chaussée-d'Antin.

Electro-Farming or the Application of Electricity to Agriculture. R. Borlase Matthews. London: Ernest Benn, Ltd., Bouverie House, 154, Fleet-street, E.C. 4. Price 25s. net.

Instructions as to the Survey of Passenger Steamships. Volume I., Text; Volume II., Standard Diagrams. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 1s. 6d. net Volume I., 6d. net Volume II.

Pulverised Coal for Steam Raising.*

THE position of pulverised fuel firing in relation to stoker firing continues debatable. The high efficiencies and complete flexibility attained with pulverised fuel has led the stoker designers to consider seriously ways and means of improving their class of manufacture. Boilers fired with pulverised coal have reached such huge dimensions that it is to be wondered if the race for supremacy between the two classes of firing can continue much longer.

The development of larger boiler units renders every feature of design—from the point of view of stokers—more difficult. Expansions, air distribution and control, together with heavy loads over long periods, are among the problems which increase with the size of units, and at best the breakdown hazards increase with the multiplicity of parts in the furnace. The extreme flexibility of pulverised coal gives it a strong advantage over the stoker-fired furnace. A mistake on the part of an operator, such as to render a departure from good combustion conditions or sudden increase or decrease of load, can easily be rectified by adjusting the air supply, dampers, &c., and bringing in or closing down the coal burners, whereas in the case of stoker-fired boilers such existing conditions would require considerable time to rectify.

Probably one of the greatest advantages of pulverised coal firing is the high average daily working efficiency. Pulverised coal fired boilers have been running regularly at from 85 to 86 per cent. boiler efficiency, 89 per cent. having been obtained on short tests. Low fusibility ash in the various grades of coal does not occasion much trouble, in view of the tremendous step forward in the development of furnace design for pulverised coal fired boilers. The higher settings, higher ratings, and higher efficiencies which obtain at present have placed a duty upon boiler furnaces that cannot be met satisfactorily by the refractories of common and standard use. This has led to the perfecting of a combination of water-cooled and refractory furnace, and one which would seem to present the greatest possibilities for the future.

The marked step towards the use of pulverised fuel in combination with air heaters makes possible very high ratings, and, naturally, very high efficiencies, which means a very intense heat in the furnace, making the necessity for water-cooled walls practically imperative. Another very important advantage derived from the use of pulverised coal is the extraordinary flexibility of the steam output of the boiler. The advantages of pulverised coal firing can be summarised as follows:—

(1) Higher boiler plant efficiency.
(2) Ability to burn low-grade fuels.
(3) Perfect combustion.
(4) Flexibility to meet varying loads.
(5) Reduced stand-by and banking losses.
(6) Greater ease of control.
(7) Low labour costs.
(8) Convenience of transport in the boiler-house.
(9) Low radiation losses.

With the ordinary methods of firing, radiation losses vary between 2·5 and 5 per cent., but in combustion chambers using pulverised coal the maximum temperature occurs in the middle of the furnace, and hence the walls, usually fitted with absorbing elements connected to the boiler circulatory system, are comparatively cool, and consequently the loss entailed is only of the order of 1·5 to 2·0 per cent.

The introduction of the Buell forced draught type of burner has opened up tremendous possibilities in the application of pulverised coal on board ship. Comparatively little has been done until recently, but, on the other hand, so much experience has been gained in other applications, that the marine problem can be approached with every confidence. The most efficient and suitable types of bunkers, feeders, burners, pulverisers, and other equipment of a similar class have been proved by experience.

* From a paper by G. E. K. Blythe, Institution of Engineers and Shipbuilders in Scotland, February 7th, 1928.

SIXTY YEARS AGO.

THE production of synthetic nitrogen compounds from the air for use as fertilisers and otherwise was well within the dreams of the chemists and engineers of sixty years ago. Like dreams of flight and other achievements, however, it was to remain a dream for a period longer than any then alive would probably have guessed. It seemed no doubt to be a simple matter and to be mainly dependent upon having at command a large and cheap supply of nitrogen. It was, at any rate, as a means of obtaining such supplies of nitrogen "for the preservation of alimentary and cereal articles and the manufacture and preparation of manures," that we, in our issue of February 28th, 1868, welcomed the news of a new process for the economical production of oxygen. The process was that of Monsieur Bousingault, and had recently been demonstrated in Paris. It was based on the fact that baryta passed into a dioxide form when heated to dull redness, and when raised to a white heat gave off its acquired oxygen and reverted to the monoxide condition. Monsieur Bousingault's experiments were stated to have been conducted in connection with "the new project for illuminating Paris," but no details of what that project consisted of were given. Presumably it involved the use of oxygen to increase the brilliance of gas lighting. The demonstration of the baryta process was carried out by means of a simple apparatus in which the material mixed with a small proportion of alkali to render it less liable to sudden disintegration was heated in the presence of air in wrought iron tubes. In a quarter of an hour several cubic yards of oxygen, it was recorded, were obtained at a small cost, and no difficulty was experienced in effecting the alternate oxidation and deoxidation of the baryta a hundred times in succession. We foresaw a wide practical field for a cheap supply of oxygen in connection with heating, lighting, the feeding of blast-furnaces, and the manufacture of iron and steel, and for the nitrogen remaining over for the purposes mentioned above. Monsieur Bousingault failed to make a practical success of his discovery, his attempts failing because, after a certain number of oxidations and deoxidations had been carried out, the baryta lost its power of reabsorbing oxygen. Ten or eleven years later, however, the brothers Brin overcame this difficulty, and the process became thoroughly practical and economical. It was worked for many years all over the world. It has now been largely superseded by the liquid air process, which is not only cheaper to carry out, but yields oxygen of increased purity.

THE ELECTRO-DEPOSITION OF SILVER.

ON Friday, February 17th, a joint conference on the electro-deposition of silver was held by the Electro-platers' and Depositors' Technical Society (London), the Sheffield Silver Trades Technical Society, and the Sheffield Section of the Institute of Metals. Professor C. H. Desch presided.

Two papers were presented to the meeting, the first on "Silver Plating," by A. C. Nicol; and the second on "Some Recent Work on Silver Plating," by Dr. E. E. Sanigar.

Mr. Nicol, in the course of his remarks, said that in its actual deposition it is possible to treat silver in ways which are altogether impossible with other metals, with the exception of gold. The process, for instance, can be interrupted and re-started without harm to the deposit. Indeed, where heavy deposits are desired this interruption is necessary. In the silver content of the silver-plating solution it is found that wide variations occur from 5 dwt. per gallon (1·71 grammes per litre) to as much as 6·00 oz. per gallon (41·04 grammes per litre). The higher contents is not necessary, and in the case of large plants represents a serious addition to capital outlay. In solutions which are used solely for light deposits, a content of about 2·00 oz. per gallon (13·68 grammes per litre) is sufficient. For many years past the addition of more free cyanide has been regarded as the grand specific for all the ills to which a cyanide solution is heir. It is fairly safe to say that a considerable portion of the cyanide which has been introduced into silver solutions has been wasted. Not so very long ago contents up to 450 per cent. and even to 500 per cent. were not uncommon. Having regard to the ease with which a free cyanide content can be accurately estimated, it is very surprising that this state of affairs has existed so long. The quantity of free cyanide present should bear definite relationship to the silver present. Repeated experiments indicate that no advantage is derived from a reduction of the carbonate content. On the other hand, the increase in conductivity which is due to its presence is a very marked advantage.

Dr. Sanigar dealt with the hardness of the silver deposit and illustrated his remarks by showing a series of interesting lantern slides of deposits which had undergone various finishing operations. He said that, owing to the "softness" of the silver deposit, the best method of measuring its hardness was by means of the scratch hardness test, in which a scratch is made on the deposit by a diamond under a suitable load and the breadth of the scratch measured under a microscope using a micrometer eyepiece.

IN explaining the causes of fire in the petroleum industry to the Institution of Petroleum Technologists, Mr. C. Dalley said that, in the discharging of tankers, the period when there is greater risk is when oil is in motion, being actually loaded or discharged. This time should consequently be reduced to the minimum. The staff on board or in the vicinity of the vessel should be the minimum necessary to carry out the operation. Another example is that where ships maintain their own steam for discharging purposes, but all fires are "drawn" when loading. It is, he said, true that in the former case—discharging—fresh air is drawn into the tanks, whereas in loading, the expelled air is mixed with petroleum vapour, and consequently may be considered the more dangerous operation, although opinions are by no means unanimous in regard to the safety obtained thereby. In effect there is an added fire risk arising out of the precautionary measure. When the fires are "drawn" the flues, coated with soot to a certain extent, cool down. The soot is loosened and on relighting the fires a miniature pyrotechnic display often results, which may be a danger, not only to the tanker itself, but to other vessels or plant in the vicinity.

Fifteen-Ton Electro-Hydraulic Ingot Casting Crane.

In the early Bessemer steel plants the ingot moulds were often placed in a semi-circular pit on one side of the building, the molten metal being taken from the converters on the other side and poured into the moulds by means of a hydraulically-operated crane rotating about a fixed pivot. Such an arrangement was limited in its scope, and to avoid its disadvantages the practice developed of carrying the metal to the moulds by an overhead travelling crane on the one hand, or of bringing the moulds on a movable truck to the converters on the other hand. The employment of movable ingot moulds was, however, believed by many engineers to have a harmful effect on the metal owing to the shocks and vibration it received when cooling, while the swaying of the ladle when transported by an overhead crane constituted an objection to that means of filling the moulds. What was wanted was a method of transporting and manipulating the ladle with ease and exactitude, and of serving at the same time the area necessary in a modern steel works. The solution of the problem now most favoured is a crane travelling on the foundry floor, as that arrangement avoids the heavy superstructure required for an overhead crane, and permits of a perfect control of the ladle. The earlier cranes of this type carried a boiler and small steam engine to provide power. The engine drove the road wheels of the crane by means of gearing, and also drove a pump to furnish hydraulic power for raising and turning the jib and manipulating the ladle. The greater convenience of electricity soon brought about the substitution of electric motors for the steam engine, but the hydraulic operation of the elevating motion still holds its place almost uncontested, although cranes with purely electric operation throughout are supplied by the makers of such machines both at home and abroad.

The general appearance of a modern type of ingot casting crane, manufactured by the Ateliers de Constructions Electriques de Charleroi, is illustrated in Figs. 1 and 2, on page 240, while Figs. 3 to 8 herewith show the arrangement of the mechanism and other particulars. The crane in question comprises a motor-driven travelling carriage, from the centre of which rises a vertical pivot which acts as the fixed ram of a hydraulic cylinder. This cylinder, which surrounds the ram, carries the main portion of the crane. On one side there are extensions in the form of two arms to carry the ladle between them. The latter can be traversed along the arms through a range of about 3ft. inwards from its extreme position, which is at nearly 15ft. radius from the centre of the pivot. On the opposite side, the structure is extended to support a platform on which are situated the pumps and operating mechanism, the whole being enclosed in a cabin and serving to counterbalance the weight of the ladle. In addition to its traverse of 3ft. 3in., the ladle can be raised, along with the platform, through a height of 2ft. 7¼in., and can also travel in a full circle of any radius from 11ft. 6in. to 14ft. 9in.

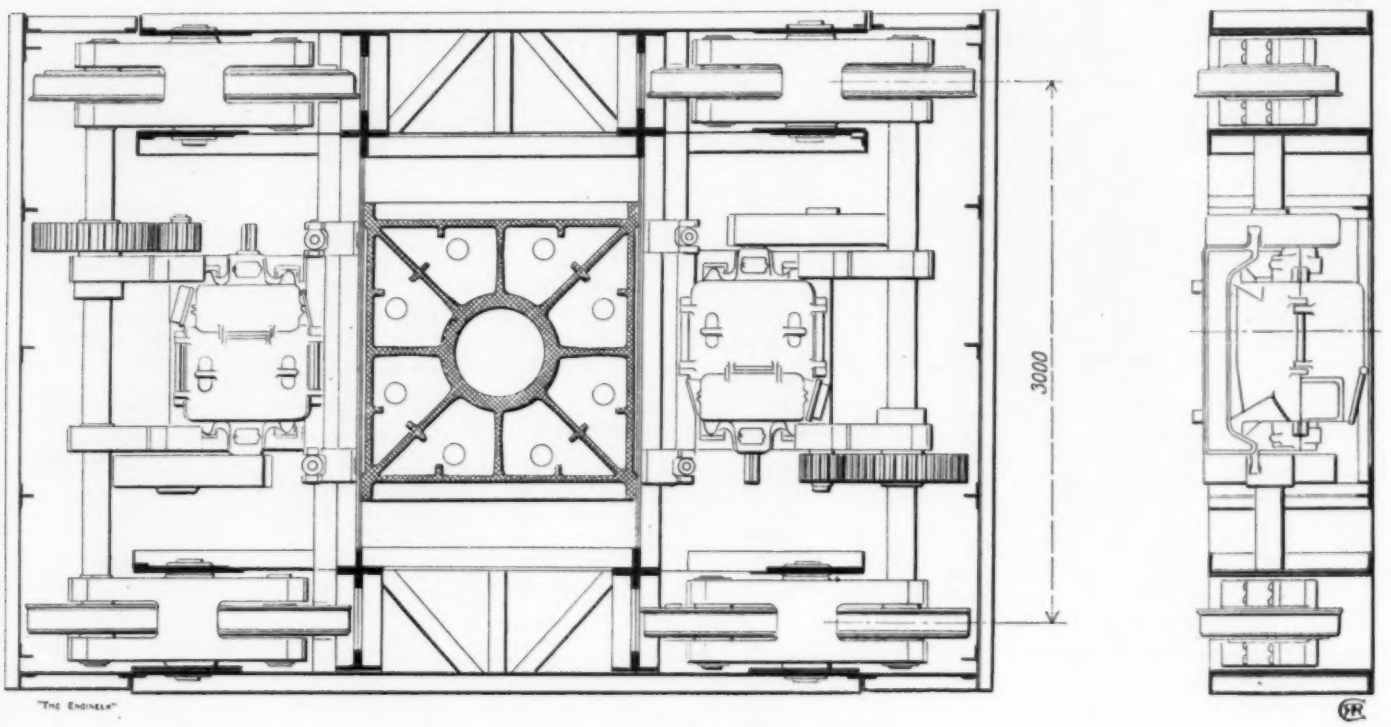


FIG. 3—ARRANGEMENT OF UNDERFRAME

The crane travels on a single pair of rails sunk in the floor at about 9ft. 10in. centres. Its weight is borne by eight wheels about 27·5in. diameter. These wheels are not directly attached to the underframe, but each pair, fore and aft, is mounted in a cast steel compensating lever, which is pivoted to the frame at its central point, so as to equalise as far as possible the load on the wheels. The two leading wheels are mounted on a common axle, as are the two trailing wheels, and each axle is driven by a separate electric motor of 50 H.P. through double reduction gearing. The arrangement will be clear by reference to Figs. 1 and 3. Each drive is sufficiently powerful by

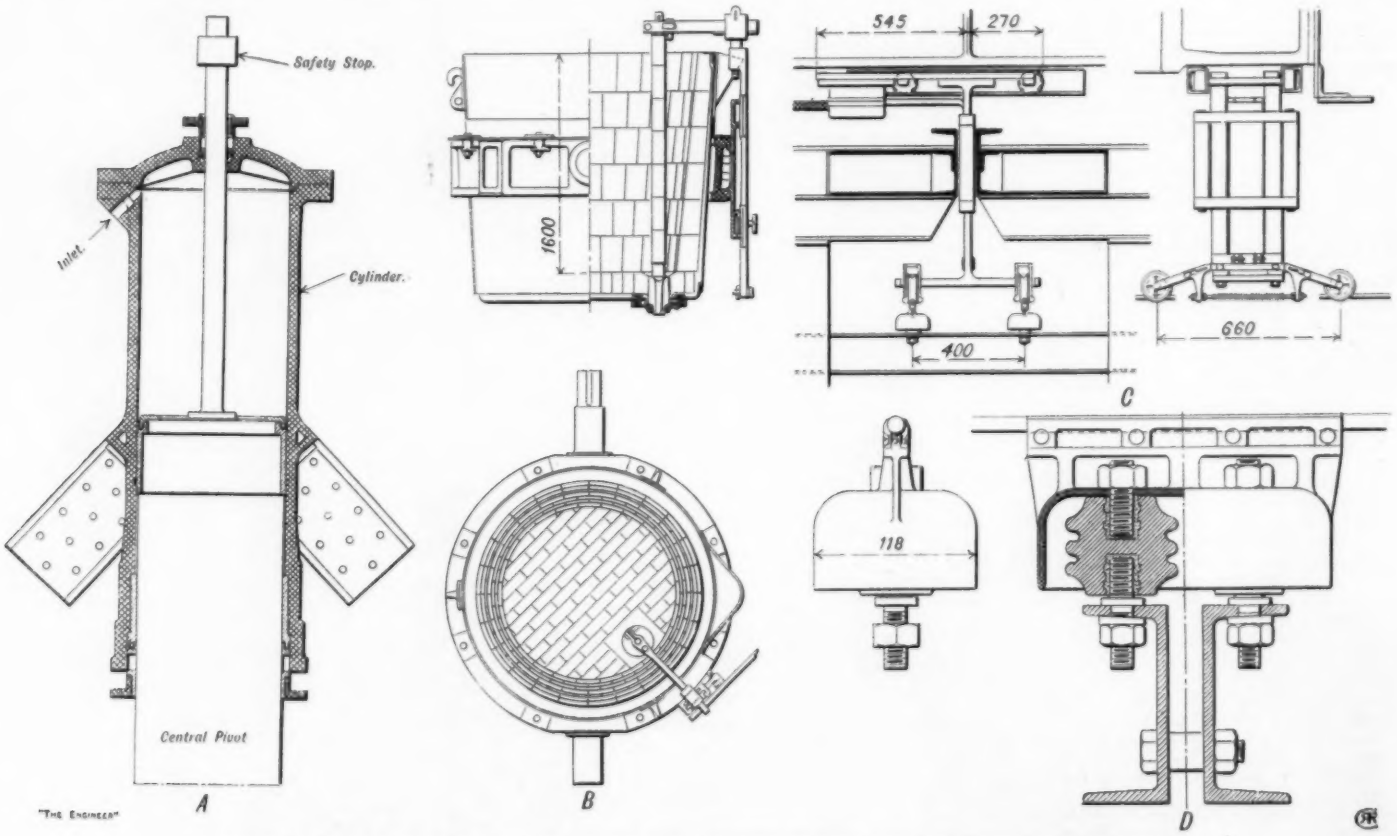


FIG. 4—HYDRAULIC CYLINDER, LADLE, CURRENT-COLLECTING PLOUGH AND LIVE CONDUCTOR SUPPORT

itself to propel the crane at normal speed, so that should either be temporarily out of action for any cause, the other will ensure the continuity of service of the crane. Each motor with its second-motion shaft is carried in a cradle which at one end can swing about the driving axle, and at the other is suspended by springs from the main framing.

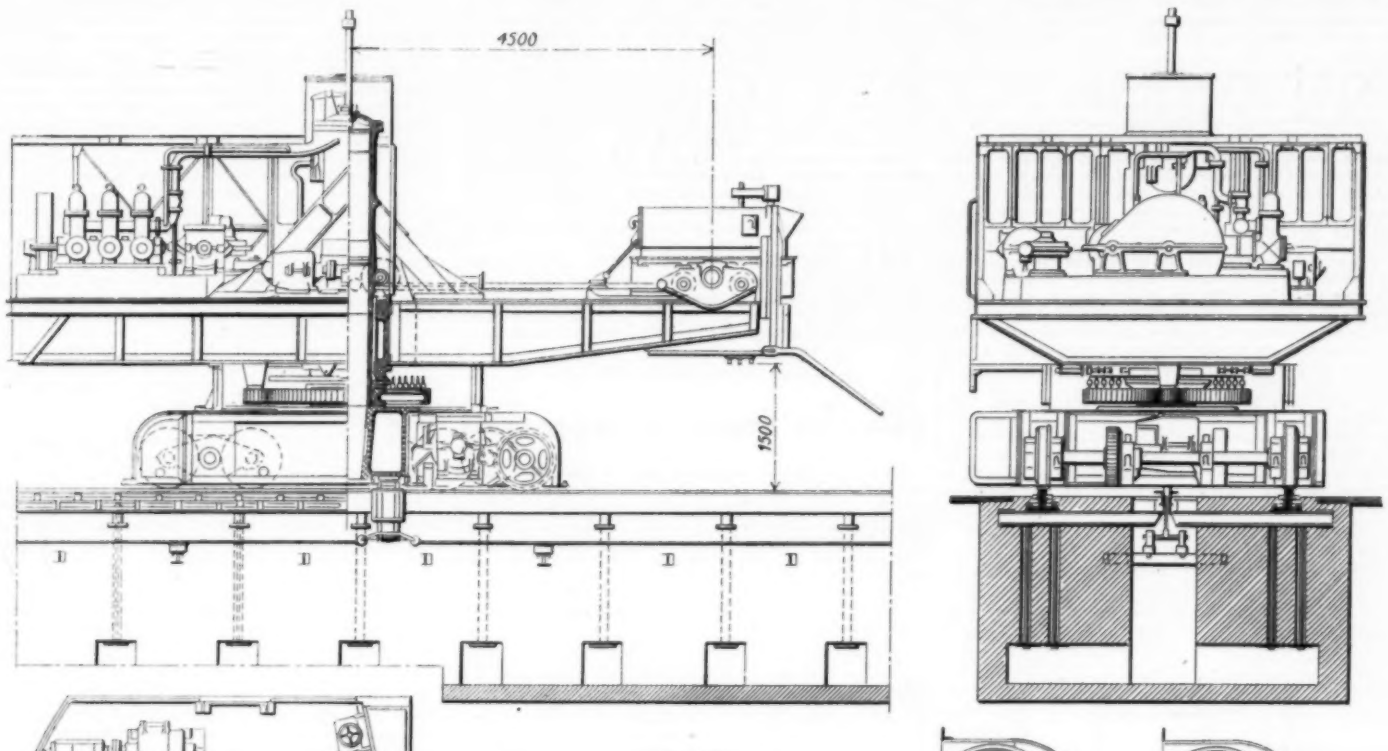


FIG. 5—GENERAL ARRANGEMENT OF CRANE AND TRAVELLING BOGIES

Great care has been taken to make the driving mechanism accessible. If an examination or a minor repair is all that is necessary, the mechanism can be got at by lifting the hinged steel cover plate—as shown in Fig. 1. Should a complete overhaul be required, the main framing can be jacked up, and then, by disconnecting the compensating lever pivots and the motor attachments, the whole of the running gear at either end of the carriage can be withdrawn complete.

The body of the crane has, as has been mentioned, both vertical and circular motion round the central pivot. It consists structurally of two main girders secured to the

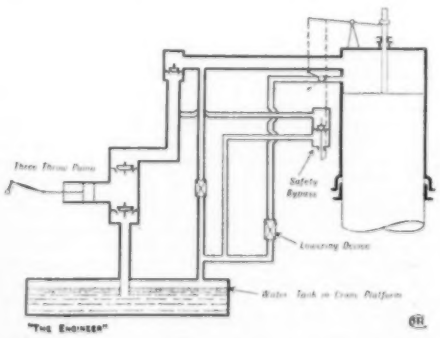


FIG. 6—HYDRAULIC CONNECTIONS TO CYLINDER

hydraulic cylinder surrounding the pivot by four sloping ties of steel plate. These ties are attached to the lugs cast on the cylinder at one end, and to the framing at the other, by turned bolts of mild steel made a light driving fit into reamered holes. The main girders constitute at one end the track on which the ladle runs, and at the other they are fitted with brackets to support the width of the cabin containing pumps, motors, &c., necessary for the various movements. The cylinder for raising the crane is similar to that used in other cases for hydraulic power. It is illustrated in A—Fig. 4. The pivot on which it works fits into a conical seating in a cast steel block built into the undercarriage, as can be seen in Figs. 5 and 8. The hydraulic connections to the cylinder are shown diagrammatically in Fig. 6. Pressure is furnished by a three-throw horizontal ram pump, driven by an electric motor through single-reduction double helical gear, and situated in the back of the cabin—as shown in Fig. 5. The pump draws its water from a reservoir in the cast iron floor block of the cabin. The raising and lowering of the crane is effected entirely by the controller of the pump motor. If the controller handle is turned in one direction it starts the pump and raises the crane. If turned in the other direction it opens the motor circuit, and operates solely the cylinder discharge valves, thus allowing the crane to descend by its own weight gently and under perfect control.

The weight of the crane being supported by the hydraulic pressure, it can turn easily at whatever height it may be. Its rotation is brought about by a pinion which engages with a large gear wheel carried on a sleeve surrounding the central pivot. The sleeve and gear wheel rise and fall with the crane, but are prevented from rotating by a pair of feather keys. The pinion, which is at the lower end of a vertical shaft passing down through the cabin floor, thus climbs round the gear ring and entrains the crane with it. The pinion is driven by an electric motor acting through spur and worm-reducing gear, the latter comprising a slipping clutch to limit the load which can come on the gearing and motor, should anything interfere with the free rotation of the crane.

So far as motions are concerned, there remains only the traversing and the tipping of the ladle to consider. Traversing is effected by means of two rods, one attached to each trolley of the ladle. These rods terminate in racks

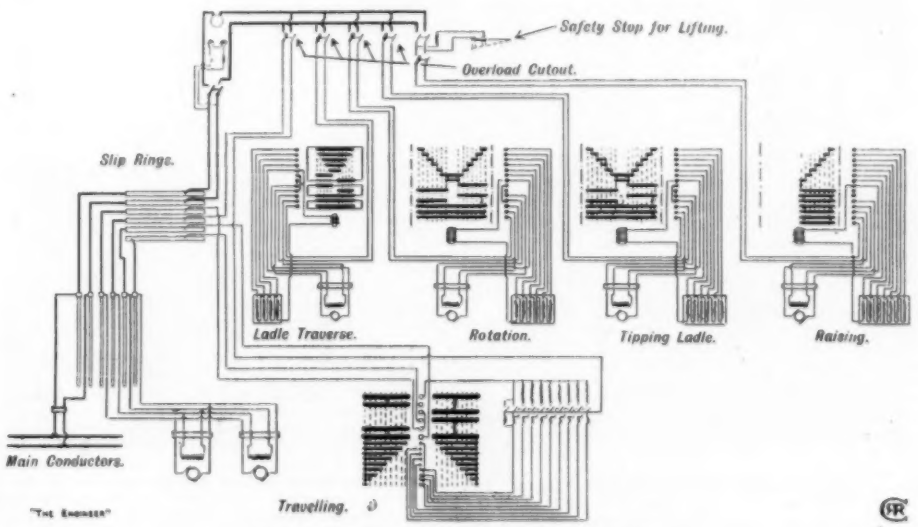


FIG. 7—DIAGRAM OF ELECTRIC CONNECTIONS

at their other ends, and are actuated by two pinions keyed to a cross-shaft in the front of the cabin. This shaft is driven by an electric motor through worm gearing and single-reduction spur gear, as can be seen in Fig. 5. The wheels of the trolleys and the trunnions of the ladle are well protected from any splashes of molten metal. The ladle tipping mechanism is operated by a motor and reduc-

tion gear similar to those employed for turning the crane, but the final pinion of the turning gear is replaced by a bevel wheel driving a horizontal shaft. This shaft, which is clearly visible in Fig. 1, runs along outside the left-hand crane girder. Its outer end is of square section, and on it is a sliding worm which engages with a worm wheel fixed to an extension of the ladle-trunnion, so that the ladle may be tipped at any point of its course along the girders. The traversing and tipping motions being quite independent of each other, may be performed simultaneously if desired.

The operation of the crane involves the control of six motors, namely, two motors for travelling, and one for each of the duties of raising the crane, turning it, traversing the ladle and tipping it. The two travelling motors, in view of their great power, are controlled by an automatic contactor, which assures a steadily progressive start without reference to the manipulation of the starting handle. The latter, having to deal only with very small currents, is easily moved. The lifting controller is operated by a lever, and the connections are so made that the load follows the movement of the hand of the operator. It will be remembered that for the descent of the crane, the controller merely regulates the discharge of the water from the lifting cylinder. The speed of descent corresponds to the degree to which the hand lever is depressed. The controllers for turning the crane and traversing the ladle are connected mechanically to a single lever in such a way that the ladle moves in the same sense as that in which the handle of the lever is moved.

The ladle itself is illustrated in B—Fig. 4, page 244. As will be seen, it has an internal diameter of about 5ft. at the top tapering down to about 4ft. 1in. at the bottom and a depth of practically 5ft. 3in. It carries a useful load of 15 tons of molten steel. It is supported by a steel belt to which it is bolted. The trunnions, one of which

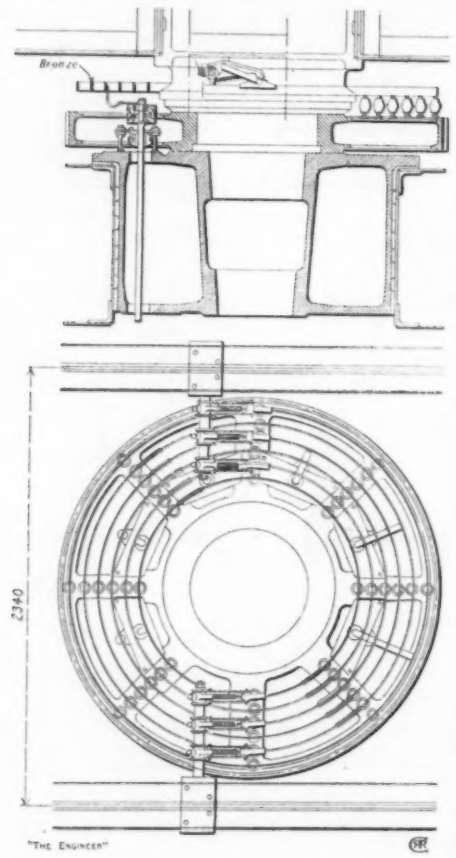


FIG. 8—CENTRAL PIVOT OF CRANE

is extended to take the tipping worm wheel, are solid with the belt, and the latter also serves to support the obturator gear. Each trunnion is supported by a little two-wheeled truck running on one of the side beams of the crane. The belt can be easily removed from the trucks as the trunnion bearings are constructed with bolted-on caps.

The plough of the crane-carriage, which picks up the current from the conductor rails, passes down through a slot, about 2¾in. wide in the floor, centrally between the crane tracks. The arrangement of the plough is shown to a larger scale in C—Fig. 4. Trolley contacts are used, two for each conductor, each pair of the trolley wheels being held down by a tension spring. The method of supporting the live conductors is shown in D—Fig. 4. The current is brought up by a two core cable through the crane carriage. The wiring arrangement of the crane will be best understood from the wiring diagram—Fig. 7. The current for the apparatus in the crane cabin is taken from a set of slip rings surrounding the central pivot—as shown in Fig. 8. These are arranged concentrically to save head room, and are carried on porcelain insulators from the gear wheel for the rotation of the crane. The contact-brushes are of bronze. Since the slip rings being attached to the gear wheel must rise and fall with the crane, provision has to be made for bringing current to them whatever their position. To this end flexible cables are used, and prove quite satisfactory since the vertical travel to be accommodated is less than 32in.

Protection of the crane mechanism is provided by many devices, apart from automatic circuit breakers on all motors and the slipping clutches which we have mentioned. To prevent the crane being raised too high, a lever fixed to the lifting cylinder is arranged to come into contact with a stop at the end of its normal travel. The deflection of the lever closes a switch and short-circuits the no-volt trip coil of the pump motor-circuit breaker. Should this device fail to work for any reason, and the crane continue to rise, the lever then operates the hydraulic safety device, indicated in Fig. 6. The water from the pump is thereby short-circuited, and though the pump continues to run, the cylinder cannot rise any higher.

The particular crane described was supplied to a steel works, where the arrangement of the working platform of the converters was such that the crane could only be elevated when the ladle arms were at right angles to the track, otherwise the cabin would have come into contact with the platform beams. To avoid danger from this cause, a mechanical locking device was provided, which prevented the movement of the elevating lever unless the cabin was in the correct position with reference to the gear wheel on the stationary pivot. Another locking device prevented the rotation of the crane when in its elevated position. Both devices could easily be put out of action when the crane was required to manœuvre out of range of the converter floor beams, but both controllers have to be in the zero position before any such interference is practicable.

The Ateliers de Constructions Electriques de Charleroi have manufactured cranes of the type described, capable of dealing with 24 tons of steel at a time, and such machines can be constructed with lifting as well as all other motions performed electrically, should it be considered desirable.

Heavy-Oil Engine Working Costs.

At the meeting of the Diesel Engine Users Association which was held on February 24th, the report of the Committee on Heavy-Oil Engine Working Costs for the year 1926–27 was presented and discussed. The present report, of which the following is a summary, forms the sixth of a series which have been issued by the Association annually. The main table accompanying the report, which we do not reproduce, contains particulars of the working costs of forty-one heavy-oil engine stations in the United Kingdom and twelve stations overseas, and a summary of it is given in Table I. It will be seen from this table that the average total engine cost of the forty-one home stations with a total output of about 44,000,000 units and an average annual plant load factor of 14·7 per cent. was ·713d. per unit generated, which compares favourably with the corresponding figure of ·799d. for the previous year. It is pointed out that the reduction in the average engine cost is due partly to the lower average fuel prices, but also to the increased capacity and output of the stations.

The total engine cost for the overseas stations with an output of over 30,000,000 units and an average annual plant load factor of 20·7 per cent. is ·665d. per unit generated.

It is noted that the outputs of some of the stations referred to in the main table have been reduced owing to supplies of electricity having been purchased in bulk, and some useful information is afforded as to the probable saving which can be effected in such cases by the use of heavy-oil engine plant for peak load purposes. This section of the report was referred to in a Letter to the Editor contributed by Mr. C. O. Milton, which appeared in The Engineer of February 17th last.

The same procedure as formerly has been followed in presenting and commenting upon the particulars reported. An additional column, headed "Plant Hours Run," has been inserted in the main table, giving, where returned, the number of hours during the year in which any portion of the respective oil engine plants was run. It was felt that this information was desirable as throwing some light on the variation between stations in the costs of labour for running the plants. An examination of the details of the costs table shows that there is a number of stations which obtain much better results than the averages in every particular. In the next report the statistical table will be divided into two portions at least, one giving results for the individual year and the other the average results over a period of years.

In reference to an inquiry as to the behaviour of engines driving alternators in parallel, replies which have been received would seem to indicate that it may be inferred that there is nothing inherent in the heavy-oil engine unfavourable to driving alternators in parallel, and that where there has been trouble with oil engine-driven plant the probability is that it has been due to incompatibility of the alternators rather than to faults in the engines.

So far as the evidence goes there is very little to choose between the three brands of oil mainly supplied as Diesel fuel oil in this country.

The report gives a list of the engines, the working results of which are set out in the main table, together with particulars of their average ages, hours run, and load conditions during the year 1926–27. There are some new features in this table. Among the larger engines there is now noted a number of the opposed-piston, two-stroke cycle type, some of which have done very good service during the year. There is also included a large single-acting, two-stroke cycle engine of new design, and a large high-revolution, land type engine. In the near future, it is stated, information will be available in reference to much larger engines of the last-mentioned type. There is also a marked addition to the number of high-compression, mechanical-injection engines in the list.

There seems to be a definite improvement in fuel consumption in accordance with the conditions of operation with the new designs of engines of each type. The enclosed arrangement is becoming general on the larger engines, with forced lubrication systems, and the lubrication consumption is generally excellent.

The older and smaller engines continue to do good service. There is one small station—not included in the main table—owning five engines aggregating 515 kW in capacity. One of them, of 80 B.H.P. and twenty-one years old, ran 4704 hours during the year. The average running plant load factor of the station was 65 per cent., and the average fuel consumption was 0·73 lb. per unit generated.

An interesting paragraph of the report deals with the analysis of engine costs expressed in percentages. Taking the forty-one home stations, the average cost per unit generated in the year 1926–27 was 0·713d. The following

TABLE I.—*Comparative Summary of Results.*

	Home stations.		Overseas stations.	
	1926–27.	1925–26.	1926–27.	1925–26.
Number of stations	41	37	12	9
Units generated	44,060,256	36,069,571	30,852,264	23,783,192
Number of engines	142	127	63	50
Engine-hours run	306,040	269,130	192,244	158,479
Average number of hours run per engine	2,155	2,119	3,050	3,168
Total capacity of engines included in return, kW	34,335	29,141	17,005	13,550
Average capacity per station, kW	838	788	1,433	1,510
Maximum simultaneous load carried on oil engine plant, kW	24,483	21,873	11,825	9,048
Ditto ditto, percentage of kW installed	71·5	75·5	69·8	66·6
Annual plant load factor, per cent. = Total units generated × 100 / Total capacity of heavy-oil engine plant × 8760	14·7	14·5	20·7	21·3
Average running plant load factor, per cent. = Units generated × 100 / Rated full load of set in kW × hours run	61·6	61·9	59·7	57·3
Average price paid for fuel oil, per ton	91s. 7d.	98s. 10d.	95s. 2d.	105s.
Ditto ditto lubricating oil, per gallon	3s. 3d.	3s. 2d.	3s. 6½d.	4s. 1d.
Average fuel oil consumption per unit generated, lb.	0·721	0·731	0·728	0·718
Average lubricating oil consumption per unit generated, gallon	0·00168	0·00149	0·00169	0·00162
Average number of rated B.H.P.-hours run per gallon of lubricating oil	1,460	1,620	1,495	1,610
Average engine cost per unit generated—	Pence.	Pence.	Pence.	Pence.
Fuel	0·353	0·387	0·372	0·407
Lubricating oil	0·065	0·057	0·072	0·077
Water and stores	0·021	0·018	0·016	0·026
Wages (running staff)	0·167	0·200	0·122	0·127
Repairs and maintenance	0·107	0·137	0·083	0·116
Total	0·713	0·799	0·665	0·753
Repairs and maintenance cost, per kW installed	£0·58	£0·71	£0·63	£0·85

statement shows the percentage value of each item of the total engine cost :—

Engine Cost per Unit Generated.

	Pence.	Percentage of total engine cost.
Fuel	0·353	49·49
Lubricating oil	0·065	9·11
Water (including treatment) and stores	0·021	2·94
Wages (running staff)	0·167	23·42
Repairs and maintenance (labour and materials)	0·107	15·04
	0·713	100·00

There was an overall fall of about 10·75 per cent. in the average engine cost per unit among the home stations, partly owing to the lower average fuel prices, but mainly to the increased capacity and output of the stations.

The engine cost per unit generated with heavy oil engine plant, even of small size, is low compared with the corresponding cost obtained with other kinds of plant under similar running conditions, and there has been a general impression, arising out of the fact that there is not much variation in fuel consumption with size, that there would not be much difference in the results of large and small oil engine stations. Size and output, however, do make an appreciable difference, because total items of cost such as those of labour and repairs and maintenance do not rise in proportion to increases in capacity. It is interesting to observe the changes in the percentage value of each item in the total engine cost during the past five years as follows, which are given in Table II.

In this table the fuel and lubricating oil costs have been adjusted to the average prices ruling during this period 1926–27. While the combined costs of fuel, lubricating oil and water and stores per unit generated have fallen by 4·57 per cent., the combined cost per unit for labour and repairs and maintenance has fallen by 43·4 per cent. The percentage value of the fuel, lubricating oil and water and stores cost of the total engine cost has increased from 48·73 to 61·54, while the percentage value of the labour and repairs and maintenance costs has fallen from 51·27 to 38·46. The first section of costs is varied chiefly by the running plant load factor, while the second is influenced to some extent by the annual plant load factor, and, apparently, more definitely by output and size of plant. Probably the improvement in fuel consumption indicated

by the above figures has been due to the slightly higher fuel economy obtained with modern engines.

A conclusion which may be drawn from the preceding particulars is, that although the average results so far recorded in these reports are in themselves good for the particular average conditions which have prevailed during the period under review, the said results are not to be taken as representative of the best which could be done with heavy-oil engine stations of recent design and equipment. The fact is that a staff necessary for properly running and maintaining a plant of a few hundred kilowatts capacity under public power station conditions could just as well, without additional strength, run an installation with a capacity of several thousands of kilowatts.

TABLE II.—*Showing Variation in Working Costs Over Five Years.*

	1926–27.		1925–26.		1924–25.		1923–24.		1922–23.	
Output (millions of units)	44·1		36·1		32·4		26·2		21·7	
Kilowatts installed (thousands)	33·3		29·1		25·4		22·5		16·6	
Average engine costs per U.G.	Pence.	Per cent.	Pence.	Per cent.	Pence.	Per cent.	Pence.	Per cent.	Pence.	Per cent.
Fuel	0·353	49·49	0·358	46·4	0·362	46·34	0·367	40·9	0·367	38·86
Lubricating oil	0·065	9·11	0·058	7·52	0·061	7·81	0·071	7·91	0·071	7·53
Water and stores	0·021	2·94	0·018	2·34	0·018	2·31	0·020	2·23	0·022	2·34
Wages (running)	0·167	23·42	0·200	25·95	0·196	25·10	0·242	26·97	0·296	31·36
Repairs	0·107	15·04	0·137	17·79	0·144	18·44	0·197	21·99	0·188	19·91
	0·713	100·00	0·771	100·00	0·781	100·00	0·897	100·00	0·944	100·00

The total output reported upon has increased by 15,000,000 units, equivalent to 15 per cent. of the previous year's output. It must be borne in mind that the list of stations is longer, but there has been a substantial increase apart from this factor. New plant installed during the year 1926–27 among the stations listed included twenty-three engines with an aggregate capacity of 6430 kW. Three of these engines were of upwards of 1000 B.H.P., and eight others were of from 500 to 750 B.H.P.

Thermal Efficiency and Fuel Consumption.—Taking the average gross calorific value of the fuel used at 19,500 B.Th.U. per pound, the heat consumption per unit generated averaged over the whole fifty-three stations, employing 205 engines varying in size from 50 to 1125 B.H.P., was 14,110 B.Th.U., equivalent to an overall thermal efficiency of 24·2 per cent. The average fuel consumption of 0·724 lb. per unit generated was very slightly better than the corresponding figure for the previous year, after taking the respective running plant load factors into account. The excess of the aggregate fuel consumption over the amount corresponding to the standard fuel consumption curve accompanying the report was about 7·4 per cent. The results of the Chelsea engines after fourteen years' service again come very near the line. Twenty-one stations recorded consumptions on or below the reference curve, and twelve others exceeded the standard figures by less than 5 per cent. The best performances are given for eleven stations, and these show a fuel consumption varying from 0·618 lb. per unit generated to 0·768 lb., B.Th.U. per unit generated 12,050 to 14,980 and percentage running load factors of 72·8 to 41·4.

It is pointed out that the excess of the aggregate fuel consumption over the requirement of the standard curve was only 7·4 per cent., if the large number of engines, their different sizes, types, ratings and situations are taken into account. In nearly all cases where the fuel consumptions exceed the standard by more than 5 per cent. a plain explanation for the variation can generally be found in something unusual in the nature or running conditions of the plant. Some of the individual results are wide of the mark by a good deal more than 5 per cent. for special reasons, which strenghtens the case for sectionalising the costs table in future reports.

At the London-road station of the Southend Corporation 260,420 units were generated from steam raised in exhaust heat boilers attached to the engines. These units were credited to the oil engines in making up the costs.

Lubricating Oil Consumption.—After a gradual improvement during the previous four years, economy in lubricating oil consumption has declined, the general average consumption per unit generated having been ·00168 gallon, whereas during the previous year the figure was ·00154 gallon at about the same running plant load factor. The position, however, is not so bad as it at first appears, as there are clear reasons for the set-back. A very considerable amount of new plant has been brought into service during the year, and there is always a tendency to over-lubricate new engines during their "running-in" periods.

If from among the home stations the results of five of them, the figures for which are high for special reasons, are excluded, the average lubricating oil consumption per unit generated for the remaining thirty-six stations is ·0011 gallon at a running plant load factor of 60·3, which is near the requirement of the working standard. Similarly, excluding the figures for Station "B" (Peru), the average consumption of the remaining overseas stations comes out at ·00137 gallon at 60·3 running plant load factor, a result which shows a marked improvement on that recorded for the same stations in 1925–26.

Repairs and Maintenance.—With regard to the cost per unit generated, under this heading the average results of 0·107d. for the home stations and 0·083d. for the overseas stations show a considerable improvement. The search for a general statement for the cost of upkeep of heavy-oil engine plant makes slow progress, but the recorded results which have been collected and tabulated show definitely that the cost per unit of plant installed and per unit of work done rapidly falls with increase in size of installation.

The constancy of the average running conditions recorded from year to year makes it clear that a very long time will be required to confirm by actual records any speculations about the influence of the other principal factors which affect upkeep costs, but the effort to anticipate results should still be carried on.

The appearance of total upkeep cost as a fairly steady average annual amount is due to its consisting of two main factors, viz., a considerable and practically constant charge for permanent maintenance staff, and an amount for material and contractors' labour. The second factor has remained fairly regular because the average running conditions have changed very little from year to year during the period under review. It is reasonable to suppose that the requirements for renewal parts, together with their costs of production, on an engine will depend mainly on the time run, and will be largely independent of energy output, and that consequently variations in the average annual service factor—which is expressed as rated kilowatt-hours run multiplied by 100 and divided by the kilowatts installed multiplied by 8760—would bring about changes in the average annual value of the second factor in the cost of upkeep. If records are kept over a series of periods long enough to enable the well-known cycle of the renewal of certain heavy engine parts to run its course, it may be found that there is a steady average value of the cost per rated kilowatt-hour run.

It is, however, too early yet to deduce from the figures an average value for cost per rated kilowatt-hour run with any confidence, owing to the large amount of new plant which has been installed during the last few years.

Remarking upon the effect of the rapid growth in the size of engines which is taking place on average figures, the report states that there is no evidence that the larger stationary engines now in service will be more expensive in upkeep per kilowatt of capacity than the older and smaller engines. The tendency seems to be in the reverse direction, which is not surprising, seeing that the labour component must fall, and that lubrication systems and means for proper attention to cooling water spaces are much improved in the new designs.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

FURNACES OF LARGE BOILERS.

SIR,—As your leading article of February 24th points out, furnace brickwork, other than arch or roof tiles supported by water tubes, can be eliminated by construeing all furnace boundaries of water tubes in boiler circulation; and the pair of boilers at Kips Bay each with economiser and air preheater, placed above a common furnace, as illustrated on page 220, shows how this has been done with the Murray fin-furnace, wherein the space between the vertical water tubes forming the water legs of the boilers, and corresponding to the water legs of a locomotive fire-box, are closed by fins welded to the sides of the tubes, while the bare tubes absorb radiant heat in the same way as do the bare tubes which form the roof boundaries and gas outlets from the water-walled furnace in which combustion is smokelessly completed. These fin-furnaces are just as installed four years ago at the New York Edison Company's power stations, both for boilers with multiple-retort stokers at Hell Gate and for boilers fired with pulverised coal at Sherman Creek.

A more recent development of the water leg furnace is shown in *Combustion*, November, 1927, in the case of the large boilers with air preheaters and Riley multiple-retort stoker, capacity 300,000 lb. steam hourly each, at the extension of the Kearny power plant, close to New York, viz., the fins are omitted and the vertical water tubes are placed close together, thus greatly increasing the absorption of radiant heat by the four vertical boundaries of the archless furnace, of which the boiler proper forms the sole roof boundary.

With stoker firing, a combustion rate of 50,000 B.Th.U. per cubic foot of furnace volume is easily maintained, and therefore 66 per cent. more steaming duty is assured than with pulverised coal firing, which, as you mention in your description of the Kips Bay boiler, which is fired by turbulent burners at the four corners of the double-ended furnace, has a maximum combustion rate of 30,000 B.Th.U. per cubic foot, and therefore needs a furnace volume of 18,900 cubic feet for 425,000 lb. of saturated steam hourly. In cases where floor area is restricted, but height unimportant, combined firing by multiple-retort stoker and by turbulent pulverised fuel burners is advantageous, especially as then there is no occasion for an ash-chilling floor screen or grid of water tubes in boiler circulation, as the incombustible residue from the pulverised fuel falling on to the thick and incandescent surface of the underfed stoker fire bed is absorbed with the ash of the untreated coal burnt on the stoker grate and discharged in saleable condition.

Water-walled furnaces are also used with the Harrington travelling grate stokers, which are not adapted for the combined firing method, as travelling grate stokers need a refractory arch forming a front extension of the boiler furnace.

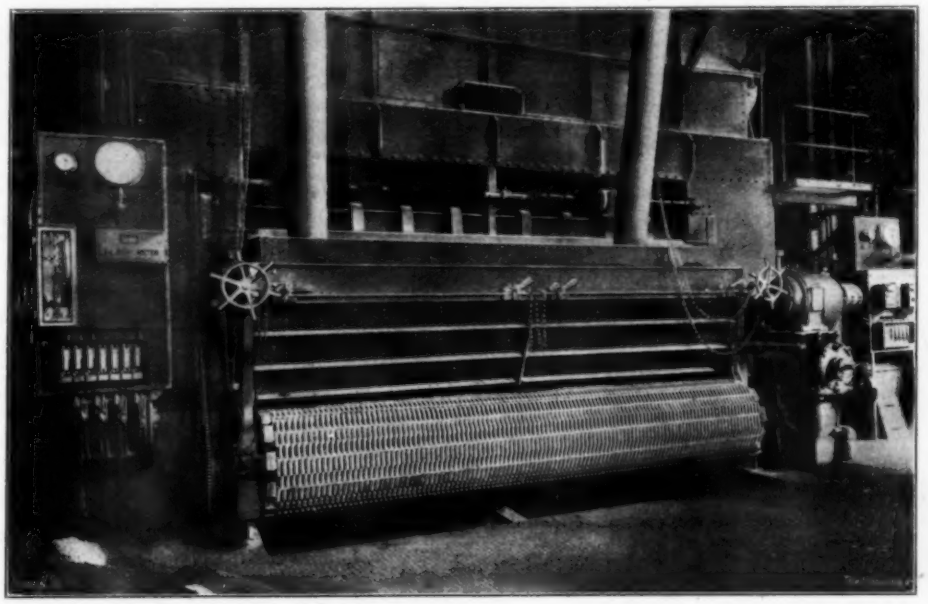
While multiple-retort underfed stokers and pulverised fuel systems are equally suited for the high-grade fuels as burnt in the New York boiler plants referred to, viz., coal very low in moisture and in ash, say, 14,000 B.Th.U. per pound as fired, and having a high ash fusion temperature, which assures a friable ash, a modern compartmented travelling grate stoker will burn all grades of solid fuels, and even those with low ash fusion temperature and high in moisture and in ash, with excellent efficiency, with or without a water-walled furnace, and with or without preheated air.

A photographic view of a brick-set Harrington stoker, 304 square feet active grate surface, on a Yarrow boiler with air preheater, at the Barking power station of the County of London Electric Supply Company, is sent herewith.

Two single-ended boilers, each fired by a single Harrington travelling grate stoker, with such cheap slack coal, will therefore give 500,000 lb. steam hourly with maximum efficiency, preferably using preheated air and a modern water-walled furnace, the front arch extension being also of water tubes in boiler circulation, but covered with refractory tiles.

RILEY STOKER COMPANY, LTD.,
CHARLES ERITH, Managing Director.

London, S.W. 1, February 27th.



BRICK-SET HARRINGTON STOKER ON YARROW BOILER AT BARKING

DIESEL ENGINES AND PEAK LOAD SUPPLIES.

SIR,—As Advisory Engineer to companies using Diesel, and preferably British Diesel, engines for electricity supply abroad, may I add my plea that the home authorities shall not, without substantially stronger economic arguments than have so far been shown, make any regulations or decisions which are likely to render it almost impossible for the British Diesel engine builder to compete in the export market?

The article and letters you have published on this subject set forth adequate proof, if it be needed, that Diesel engines can be put on to full load at a minute's notice, that they cost nothing in stand-by charges, that they are thoroughly reliable for electricity supply, that the

maintenance charges are reasonably low, and that they retain their high thermal efficiency throughout their life. There is also ample proof that the average life of the Diesel engine is at least double the ten years for which the Electricity Commissioners grant loans; the first Diesel engine I installed, in 1910, is still working daily with almost its original efficiency.

Dealing first with existing Diesel power stations, no one disputes that, where it is available, they should take the high load factor component of their output from the "grid," but practically all of them are far too small, *i.e.*, are in too sparsely populated districts to make it at all probable that they will become sites for main receiving and distributing stations at 132,000 volts. Consequently, comparatively expensive underground secondary cables will be required for the bulk supply to them, and this, coupled with the fact that their demands will be relatively small in annual output, means that these stations are not likely to receive the lowest grid prices. It is believed that the Central Board hope to be able to give the supply to the more favourably situated receiving stations at £3·8 per kW of demand and ·22d. per unit, and we may assume that the supply to the secondary receiving stations could not be done for less than £4 per kW and, say, ·23d. per unit. Against ·23d. per unit for grid supply the Diesel Engine Users Association records quoted by Mr. Milton show that on an average load factor of 20·5 per cent. the average costs of generation were ·713d. The existing engines, if used for peak load supply only, would be run at approximately full load, and it may be safely taken that the generating cost per unit would not exceed ·7d. per unit, or, say, ·47d. (*i.e.*, ·7d. — ·23d.) per unit more than the grid units cost.

Normally an existing Diesel station retained for peak load supply would be shut down entirely for at least six months in the year, as far as generation is concerned, and it would only be required to run for a short shift daily for the remainder of the year, probably rarely exceeding six hundred hours per annum total running. On such a plant running for 600 hours per annum there would be a saving in fixed (grid) charges of £4 per kW of peak taken and an extra running cost, as compared with the grid supply, of 600 × ·47d. = £1·18, or a net saving to the local undertaking and the community it serves of £4 less £1·18 = £2·82 per annum per kW of peak load taken. If the plant had to be run for fewer hours the saving would naturally be increased, and for longer hours it would be reduced, but in any case it does not seem fair and reasonable that the local undertaking should be refused the opportunity of making substantial savings of this nature.

Secondly, there will be many main receiving stations which have peak loads of from 500 kW upwards which occur for less than even three hundred hours. The article of January 20th quoted figures showing that in the London area the peaks are expected, after 1932, to occur over less than 150 hours per annum, and the writer also shows that new Diesel generating plant of large size, including switchgear and buildings which would be common to steam plant, can be installed for £14 per kw; for sets of about 500 kW the cost may be safely taken as not exceeding £22 per kW. Assuming that twenty-year loans be granted for such plant, then the fixed charges, at 8 per cent. per annum, would amount to £1·76 (8 per cent. on £22) for small sets, and £1·12 (8 per cent. on £14) for the large sets referred to. Calculating in the same manner as adopted above for the existing stations, the extra running cost per unit generated would be ·70d. — ·22d., or ·48d. per kWh, and the annual savings which might be made in main receiving stations—or areas—where the peak loads persist for, say, 250 hours per annum would appear to be approximately as follows:—

With Small Generating Sets.

	Per kW.
Fixed charges, £3·8 less £1·76	£2·04
Less 250 hours' extra cost at ·48d. per kWh ..	£0·50
Net saving per kW of peak plant, per annum ..	£1·54

With Generating Sets of 7500 kW.

Fixed charges, £3·8 less £1·12	£2·68
Less 250 hours' extra cost at ·48d. per kWh ..	£0·50
Net saving per kW of peak plant, per annum ..	£2·18

Or on a 500-kW set the saving would be 500 × £1·54 = £770.
Or on a 7500-kW set the saving would be 7500 × £2·18 = £16,350.

I have made no allowance in the above figures for spare plant because on 250 hours' running per annum the question of spare plant would not arise. Surely the savings indicated ought not to be turned down.

J. G. GRIFFIN, M.I.E.E.

Moorgate, E.C. 2.
February 27th.

WATER POWER AND THE ENGINEERING SOCIETIES.

SIR,—At the present time when so much is being done to develop the water power resources of the world, it is certainly a pity that such a small share of the contracts comes to this country, and it would appear that the formation of an "Institute of Hydro-electric Engineers" might be a step in the right direction. It would at least provide a centre to which water power questions might be addressed and emphasise the ability of British firms to supply, not only the material, but the brains and experience necessary.

Would it be beyond the bounds of hope that one of the great engineering societies, the Institution of Civil Engineers or the Institution of Mechanical Engineers, might father the infant Institute of Hydro-electric Engineers, and provide it occasionally with a home and a room in which it might hold its meetings? This would at least solve one of the problems, and might prove a valuable first step in bringing to this country a fair share in the coming contracts for the development of the enormous water power resources of the world.

February 26th. W. D. J. T.

STEAM NOZZLES RESEARCH.

SIR,—In the discussion of the fifth report of the Steam Nozzles Research Committee referred to in your issue of January 27th, a speaker stated that "he had observed that abroad Brown, Boveri and Co. had patented the application of the Committee's results to reaction turbines for fixed and moving blades. That use of the Committee's research work ought, he thought, to be stopped."

To these remarks, we beg to state that our reaction blading of the type protected by our British patent No. 252,702 had been evolved, tested, and used prior to the publications of the Steam Nozzles Research Committee referred to.

BROWN, BOVERI AND CO., LTD.,
J. H. MEYER.

Baden, February 21st.

LAUNCHES AND TRIAL TRIPS.

"MANSEPOOL," steamer; built by Wm. Gray and Co., Ltd., to the order of the Pool Shipping Company, Ltd.; dimensions, 418ft. by 53ft. 6in. by 29ft. 5½in. Engines, 26in., 43in., 71in. diameter by 48in. stroke, pressure 180 lb.; constructed by the builders; trial trip, January 27th.

"NOHATA," steamer; built by William Gray and Co., Ltd., to the order of the Hain Steamship Company, Ltd.; dimensions, 412ft. by 54ft. 2½in. by 27ft. 7½in. Engines, triple-expansion, 26in., 43½in., 73in. diameter by 48in. stroke, pressure 200 lb.; constructed by the builders; trial trip, January 26th.

"EASTBOROUGH," steel screw steamer; built by Craig, Taylor and Co., Ltd., to the order of Humphries (Cardiff), Ltd.; dimensions, 414ft. by 53ft. 6in. by 35ft. 6in. Engines, 25½in., 42in., 70in. diameter by 48in. stroke; pressure, 180 lb.; constructed by Blair and Co., Ltd.; trial trip, January 28th.

"LAVALDOC," steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Paterson Steam Ships, Ltd.; dimensions, 253ft. long. Engines, inverted marine type with three cranks; constructed by the builders; trial trip, recently.

"PINTO," motor vessel; built by Harland and Wolff, Ltd., to the order of MacAndrews and Co., Ltd.; dimensions, 270ft. by 39ft. by 17ft. 6in; 1345 gross tonnage. Engines, six-cylinder, single-acting motor; constructed by the builders; trial trip, February 2nd.

"MONDOC," steamer; built by Swan, Hunter and Wigham, Richardson, Ltd.; to the order of Paterson Steamships, Ltd.; dimensions, 253ft. by 100ft. by 35ft. Engines, inverted marine type, with three cranks; constructed by the builders; launch, February 10th.

"YARRAVILLE," oil tank vessel; built by Lithgows, Ltd.; to the order of the Vacuum Oil Company, Ltd.; dimensions, 460ft. by 62ft. 6in. by 36ft. 6in. Engines, inverted, direct-acting, triple-expansion, pressure 220 lb.; constructed by D. Rowan and Co., Ltd.; launch, February 13th.

"BEAVERHILL," twin-screw steamer; built by Barclay, Curle and Co., Ltd., to the order of the Canadian Pacific Railway Company; dimensions, 520ft. by 61ft. 6in. by 40ft. 6in.; 10,000 tons gross tonnage. Engines, twin-screw sets of single reduction geared turbines, pressure 250 lb.; constructed by the builders; trial trip, February 15th.

"KING JOHN," motor cargo vessel; built by Harland and Wolff, Ltd., to the order of the King Line, Ltd.; dimensions, 400ft. by 54ft. 6in. by 34ft. 8in.; 5180 gross tonnage. Engines, six-cylinder, four-cycle, single-acting Diesel; constructed by the builders; trial trip, February 16th.

"ALICIA," steam oil tanker; built by Sir W. G. Armstrong, Whitworth and Co., Ltd., to the order of the Anglo-Saxon Petroleum Company, Ltd.; dimensions, 305ft. by 50ft. Engines, twin-screw, inverted, direct-acting, triple-expansion, surface condensing, pressure 180 lb.; constructed by the builders; trial trip, February 21st.

"COPTIC," twin-screw motor ship; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Shaw, Savill and Albion Company, Ltd.; dimensions, 500ft. long; 11,190 tons deadweight. Engines, twin reversible, single-acting, two-stroke Diesel; constructed by the Wallsend Slipway and Engineering Company, Ltd.; launch, February 21st.

ENGINEERING GOLFING SOCIETY.—The nineteenth annual general meeting of the Engineering Golfing Society was held, by permission of the Council of the Institution of Civil Engineers, in the Institution building, on Wednesday, February 29th, the retiring captain, Mr. P. L. Riviere, in the chair. The office bearers for the current year were elected as follows:—President, Sir Alexander Kennedy; vice-presidents, D. A. Stevenson, E. L. Mansergh, F. J. Walker, S. Price-Williams, W. H. Shortt, E. W. Timmis, K. A. Wolfe Barry, W. L. Mansergh, S. R. Lowcock; captain, H. G. Hale; honorary secretary and treasurer, H. P. Allison; honorary auditor, S. C. Lewis; elected members of committee, P. B. Brown, W. A. Brown, C. S. Davidson, H. P. Gaze, R. J. M. Inglis, W. R. Manning, D. T. Powell, P. L. Riviere, H. C. Siddeley.

NEW ZEALAND MACHINERY REQUIREMENTS.—The High Commissioner for New Zealand, Sir James Parr, has received specifications relating to a Government order to be given for the manufacture, supply and erection in the Dominion of a pipeline approximately 2464ft. long. This pipeline is to connect with the Lake Coleridge power station. The pipes range from 60in. to 84in. in diameter, and the whole is to be complete with manholes, air inlet valves, &c. Tenders for this work are receivable in New Zealand up to May 29th, 1928. Another requirement by the same Government is a 7500 kW generator and turbine for the Public Works Department; while, in connection with the new railway workshops which are in course of erection, and for which much material has already been purchased in this country, tenders are now being called for the following:—Thirteen electric rivet heaters, four ventilating and heating units, four battery shunting locos. and charging sets, four plane milling machines, two sand-cutting machines, four automatic electric melting sets, four circular saw benches, three oil-fired spring furnaces, seven alternating-current arc welding sets, two paint-spraying machines, four universal type spot welding machines. Full details regarding all this material are obtainable from the High Commissioner for New Zealand.

Catalogues.

HERBERT MORRIS, Ltd., Loughborough.—Pamphlet on "Morris Electric Lifts."

PETTERS, Ltd., Yeovil.—Leaflet on the Petter 7·9 kW petrol electric generating plant.

VERDON, CUTTS AND CO., 87, Fargate, Sheffield.—Leaflet on the V.C.C. welding electrode.

STOTHERT AND PITT, Ltd., Bath.—Copy of catalogue F10 on Rotary displacement pumps.

SUFFOLK IRON FOUNDRY (1920), Ltd., Stowmarket, Suffolk.—Pamphlet on "Welding Cast Iron."

HERBERT TERRY AND SONS, Ltd., Redditch.—A leaflet describing the "Terry" flexible shaft outfit.

THE MARCONI WIRELESS COMPANY, London.—Copy of publication No. 443D on Marconi valves.

KASENIT, Ltd., Henry-street, S.E. 1.—Booklet relating to the case-hardening and heat treatment of steels.

COMBUSTION ENGINEERING CORPORATION, New York.—Publication I.C.-1, entitled "An Achievement."

A. J. PHILIP, Gravesend, Kent.—Descriptive pamphlet of the "Sinbad" patented load moving appliance.

C. A. VANDERVELL AND CO., Ltd., Acton, W. 3.—Catalogue on electrical equipment for commercial vehicles.

WALTERS ELECTRICAL MANUFACTURING COMPANY, Ltd., Kensal-road, W. 10.—Linesman's tools list No. 127.

THE CAMBRIAN WAGON CO., Ltd., East Moors-road, Cardiff.—Copy of fourth edition catalogue on wagons, &c.

FRY EQUIPMENT COMPANY, Ltd., Astor House, Aldwych, W.C. 2.—Particulars of the "Fry" visible petrol pump.

DAVEY, PAXMAN AND CO., Ltd., Colchester.—Catalogue No. 932 giving detailed descriptions of heavy-oil engines.

BRITISH ROLLING MILLS, Ltd., Tipton, Staffs.—"A Treatise on Steels, with Special Reference to Case-hardening Steels."

HADFIELDS, Ltd., Sheffield.—Copy of pamphlet No. 155 on Hadfield's Hecla and Era steels for motor vehicles and aircraft.

JOHN COCHRANE AND SONS, Ltd., 39, Victoria-street, S.W. 1.—Brochure illustrating some of the work carried out by the firm.

THE HARLAND ENGINEERING COMPANY, Ltd., 72-74, Victoria-street, S.W. 1.—List X62-2710 on Harland oil-circuit breakers.

MCGRAW-HILL PUBLISHING COMPANY, Ltd., 6 and 8, Bouverie-street, E.C. 4.—Sectional List No. 2 of electrical engineering books.

C. F. CASELLA AND CO., Ltd., 49-50, Parliament-street, S.W. 1.—Copy of pamphlet entitled "Signs that Show Your Eyes Need Help."

MEDWAY'S SAFETY LIFT COMPANY, Ltd., 1-2, Silex-street, Blackfriars-road, S.E. 1.—Booklet on "Medway's Electric Lifts."

MARSHALL, SONS AND CO., Ltd., Gainsborough.—Publication No. 1799 on Marshall portable and semi-portable steam engines (Class S).

NEW YORK EDISON COMPANY, New York.—Pamphlet on "The East River Generating Station of the New York Edison Company."

BRITISH ROPES, Ltd., 32, Cavendish-square, W. 1.—Folder illustrating the raising of German ships at Scapa Flow using the firm's ropes.

TANGYES, Ltd., Cornwall Works, Birmingham.—Catalogue No. 347 on twin cylinder and four-cylinder types of cold-starting heavy oil engines.

A. W. FABER, 13-14, Camomile-street, E.C. 3.—Booklet, "Instructions for the use of A. W. Faber's Castell Precision Calculating Rules."

F. GILMAN (B.S.T.), Ltd., Regent-street, Smethwick.—The firm's 1928 catalogue dealing with electrical, petrol and pneumatic boiler scaling tools.

REAVELL AND CO., Ltd., Ranelagh Works, Ipswich.—Pamphlets No. 119a and 161, describing the "John Bull" concrete breaker and its work.

THE OIL WELL ENGINEERING COMPANY, Ltd., Cheadle Heath, Stockport.—Bulletins 261 to 276 supplementing the firm's general catalogue of oil field machinery.

MAVOR AND COULSON, Ltd., 47, Broad-street, Mile End, Glasgow.—Leaflets dealing with ironclad control pillars and lighting fittings for mining service.

JOSHUA BUCKTON AND CO., Ltd., Well House Foundry, Leeds.—Copy of the general catalogue of machine tools and testing machines, and the firm's worm gear booklet.

BRITISH STEAM SPECIALTIES, Ltd., Fleet-street, Leicester.—The firm's 1927 catalogue—a 300-page volume giving particulars of valves and steam fittings of every description.

CROFTS (ENGINEERS), Ltd., Thornbury, Bradford.—Booklet on chain driving, including roller chains, inverted tooth silent chains, and cast malleable chains for slow driving.

J. H. TUCKER AND CO., Ltd., King's-road, Tyseley, Birmingham.—Folder on Tucker ironclad gear. Leaflet C.P. 387 on "Solid Link Type Quick Break Tumbler Switch."

G. AND J. WEIR, Ltd., Cathcart, Glasgow.—Copies of catalogues:—(1) The Weir patented turbo-feed and turbo-electric pumps; (2) Weir auxiliary machinery for motor ships.

THE BRITISH OXYGEN COMPANY, Ltd., Angel-road, N. 18.—Three valuable little reference books: "Gas Welding and its Applications," "Hints on Oxygen Metal Cutting," and "Hints on Gas Welding."

GODFREY ENGINEERING WORKS, Boundary-road, Westbury-avenue, Wood Green, London, N. 22.—Copies of English and American catalogues, on the Godfrey oxygen jet-cutting machine.

STOTHERT AND PITT, Ltd., Bath.—Latest roadmaking and quarry plant catalogue dealing with tar and bituminous macadam plants, batch and continuous types of dryers, asphalt plant, &c.

STEWARTS AND LLOYDS, Ltd., 41, Oswald-street, Glasgow.—Publication giving particulars of recent developments in the firm's works, with the products and capacity of each works.

THE GENERAL ELECTRIC COMPANY, Ltd., Magnet House, Kingsway, W.C. 2.—A sectionalised catalogue of nearly a thousand pages illustrating and describing the products of the company, which include plant for all branches of electrical engineering.

THE CONSOLIDATED PNEUMATIC TOOL COMPANY, Ltd., 170, Piccadilly, W. 1.—S.P. 106, "Pedwyn Balancers"; S.P. 109, "Portable Plants"; S.P. 110, "C.P. Scaling Hammer"; S.P. 127, "Demolition Tools"; S.P. 128, "Paint Spraying"; S.P. 130, "Hicycle Machines"; S.P. 131, "No. 2 Boyer Clay Digger."

W. CANNING AND CO., Ltd., Great Hampton-street, Birmingham.—Catalogue 1927, describing in detail the plating plant and accessories manufactured by the company, which include polishing machines, emery belt grinding machines, disc grinding machines, tumbling barrels, polishing brushes and buffs, wire wheels, &c.

Launch of H.M.S. Sussex.

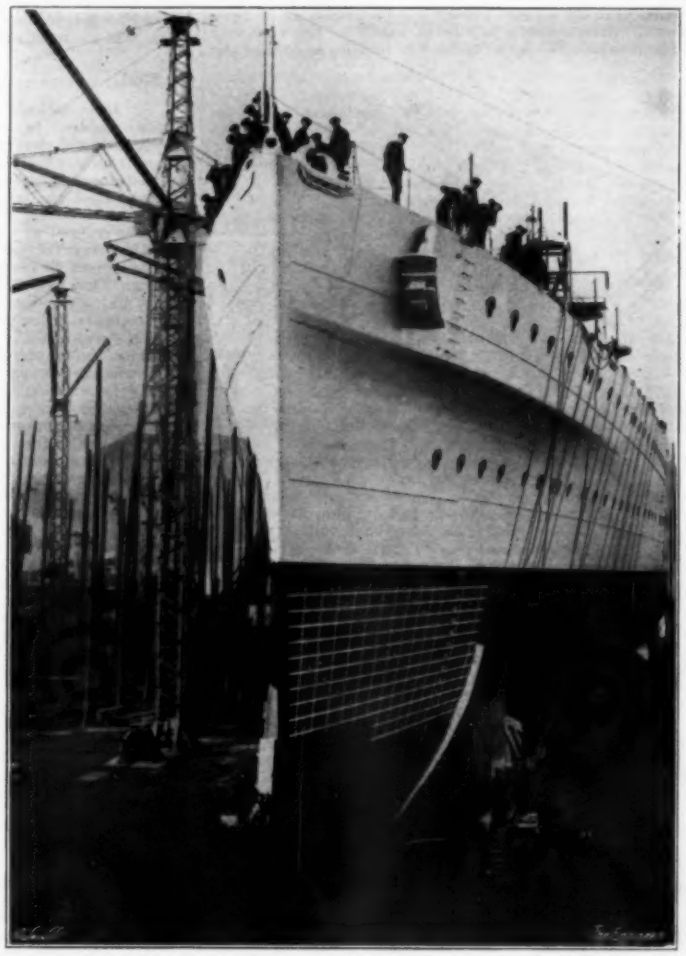
H.M.S. SUSSEX, the eighth cruiser of the "County" type to go afloat, was launched successfully from the yard of R. and W. Hawthorn, Leslie and Co., Ltd., at Hebburn-on-Tyne, on February 22nd. The naming ceremony was performed by Lady Leconfield, wife of the Lord-Lieutenant of the county, after which the ship is called. The "Sussex" is one of a group of four cruisers voted under the Navy Estimates for 1925-26, and known as the "London" class. The nameship was launched at Portsmouth on September 14th last, and the "Devonshire" at Devonport on October 22nd, while the last unit, "Shropshire," is still on the stocks at Beardmore's yard, Dalmuir. These four vessels differ in certain details from the "Kent" class, which preceded them. The leading dimensions, however, are understood to be the same, viz., length overall, 630ft.; breadth, 68ft. 4in.; mean draught, 16ft. 3in.; standard displacement, 10,000 tons; but it is reported that modifications in the propelling plant and form of hull will enable the "Londons" to attain a speed of 32 knots, which is half a knot more than the contract speed of the "Kent" class. The "Londons," it may be added, were designed by Sir W. J. Berry, the present director of Naval Construction, whereas the plans of the "Kent" class were got out by his predecessor, Sir E. T. d'Eyncourt.

In the "London" class there are no external bulges, the absence of which may account, in part, for the anticipated increase in speed. Otherwise the protective features, of both types appear to be similar. Nor has there been any change in the armament, which consists of eight 8in. guns paired in turrets, four 4in. A.A. and many lighter pieces, and eight deck torpedo tubes mounted on quadruple carriages—an innovation in torpedo equipment. The "Sussex," which is being engined by her builders, will have a maximum capacity of 3400 tons of fuel-oil. This should give her a steaming endurance considerably greater than that of any cruising ship previous to the "County" type. Her equipment will include at least one seaplane, with a launching catapult, and a special derrick for hoisting the machine inboard when it descends alongside the ship after completing a flight.

In profile the "Sussex" will closely resemble the "Kents," having the same flush-decked hull and high freeboard, with two gun turrets placed forward and two aft. It may be, however, that her three funnels will be raised to a greater height, as has already been done in the "Suffolk," one of the "Kent" group. The resulting change in the appearance of this ship is most striking, and a decided improvement from the æsthetic point of view.

As the keel of the "Sussex" was laid in February, 1927, she was brought to the launching stage in almost exactly twelve months, and has, therefore, been built more rapidly than any other warship of major tonnage commenced since the war. The slow rate of construction on other vessels has been due, of course, to circumstances over which the builders had no control, such as industrial troubles and reasons of policy and finance. It is quite certain that any of our leading shipyards could build and complete a "County" cruiser in less than two years if called upon to do so.

The present position with regard to 10,000-ton cruisers may be briefly stated. Five are practically finished, three are being completed afloat, and three have to be launched. No further vessels have been ordered to date, as the ship of this type provided for in the current Navy Estimates was cancelled in November last. We have, therefore, eleven cruisers of the 10,000-ton class built and being built. If the Australian ships, "Australia" and "Canberra," are included, the total for the British Empire is thirteen. Two other cruisers of smaller tonnage have been authorised: the "York," now under construction by Palmers Shipbuilding and Iron Company, at Jarrow, and the "Exeter," to be laid down at Devonport during the present month. They will displace about 8000 tons, and be armed with six 8in. guns.



H.M. CRUISER SUSSEX ON THE STOCKS

THE ELECTRIC FITTINGS STATUTORY COMMITTEE.

OUR readers will remember that an Electric Fittings Statutory Committee was appointed by the Electricity Commission under Sec. 48 of the Electricity (Supply) Act, 1926. This Committee has held a few preliminary meetings to settle procedure, and a few words concerning its chief functions may now be given. The section, called the "Sale of Fittings" Section, under the Act empowers joint electricity authorities and local authorities to *sell* "fittings" which term includes "electric lines, apparatus, and appliances for lighting, heating, and motive power, and for all other purposes for which electricity can or may be used." In addition, such authorities are empowered to "install, connect, repair, maintain, and remove" such fittings, and to charge for doing so.

One of the questions with which the Committee will doubtless have to deal, as soon as a case arises, is: What is a "fitting," for the purpose of the section?

An authority must not manufacture fittings unless expressly authorised to do so by special Act or Order.

Sales can be made only to the consumer on the authority's mains or to a contractor who requires the goods for re-sale to a consumer on the authority's mains.

Another clause deals with the matter of price, which furnishes the present Committee with its chief function. The price to be charged by the authority to a consumer is not to be less than the "recognised" retail price, and to a contractor not less than the "recognised" trade price. What is "recognised" the Committee will have to determine.

The Committee is invested with the duty of generally advising and assisting all persons concerned as to the method of giving effect to the section; and the chairman is empowered to inform all such persons that it will be pleased to hear from them in that or in any other before-mentioned connection.

The chairman of the Committee is Mr. D. N. Dunlop, and the members are:—Messrs. R. W. L. Phillips, A. Nichols Moore, S. E. Fedden, F. W. Purse, Alex. C. Cramb, and Councillor J. Moore, representing I.M.E.A.; Messrs. H. H. Berry and J. S. Ramsden, representing B.E.A.M.A.; Mr. F. Winstanley, representing E.L.F.A.; Mr. F. J. Collis, representing E.A.M.A.; Mr. C. W. Sully, representing E.L.M.A.; Mr. W. F. Bishop, representing C.M.A.; Messrs. A. G. Beaver and G. Donovan, representing E.W.F.; Messrs. H. J. Miles, T. E. Alger, H. Marryat, and L. C. Penwill, representing E.C.A. (Eng.); Messrs. James Allan and Walter Finlay, representing E.C.A. (Scot.).

GAS DISTRIBUTION FROM COLLIERIES.

THE idea of producing gas in the colliery districts and distributing it over long distances has taken practical form in the Ruhr, where the A.G. für Kohlenverwertung has made propositions for the supply of gas to the big towns in Germany. The scheme does not appear to have been accepted generally with enthusiasm, and has been declined by Frankfort, apparently for the reason that municipalities possessing gasworks look upon the new venture as threatening a dangerous competition. The distributing company endeavours to remove that impression by explaining that there is no intention to monopolise the gas-making industry in the coal mining areas and that local gasworks will continue to exist, although they will necessarily have to undergo a complete reorganisation in the future when the big gasworks will absorb the smaller ones and will be equipped with the most modern plants. Companies owning those ultra-modern gasworks will not suffer from any competition from the gas produced at the collieries, since both will be able to extend very largely their field of operations. There is, nevertheless, some doubt whether the scheme will prove economical, for while gas from coke ovens involves the distillation of twice as much coal as in a gasworks, it is obvious that a distribution from the collieries can only be profitable in the event of the coke going into consumption. It is argued that the cost of transport would place the fuel at a great disadvantage as compared with the coke from gasworks which can all be absorbed locally. So far as metallurgical coke is concerned, its consumption may vary considerably with the fluctuations in industrial activity, and if the gas industry developed at the collieries the enterprise might be burdened with unwieldy stocks of coke. Nevertheless, it appears likely that the scheme will be put into operation in the Ruhr, and, if so, the results of its working will be watched with interest.

South African Engineering Notes.

New Engines for Rhodesia.

AT the headquarters of the Rhodesian Railways the question of the number of additional locomotives which are likely to be required to deal with the anticipated increase in traffic during the latter half of next year has been having attention. Close calculating indicates that eighteen new locomotives will be wanted, and it has been decided that these new engines shall be of similar design to the twenty placed in service, *i.e.*, 12th Class "Mountain" type, with a 4–8–2 wheel arrangement. Certain minor moderations and additions will be introduced as a result of Rhodesian experience of that class of engine, though it is believed that the mechanical and transportation officers are very well satisfied with the results so far attained. The eighteen new locomotives are required to be in service at the latest by July of this year, and the order for their construction has been secured by the North British Locomotive Company, of Glasgow. Consideration is also being given to the purchase of more of the Garratt locomotives, which are giving such useful service on the heavily graded line between Umtali and Villa Machado in Portuguese East Africa. The large increases in passenger goods and mineral traffic—up to June 30th last more than 80,000 passengers had been carried in the first nine months of the financial year 1927 over those conveyed in the similar period of 1926, while the total earnings of the railways for the period show an increase of £590,000 over the corresponding period of the previous year—is causing difficulty in providing adequate rolling stock. The position will, however, be relieved soon by the arrival of new stock at present being built in England, which includes ten first-class coaches, six ordinary native coaches, and six composite third-class and native coaches. Four new dining cars are on order and are expected in Rhodesia early in the New Year.

German Tenders Accepted—Ninety Locomotives to Cost £560,213.

The Union Railway Administration has accepted the tenders of five German firms for the supply of ninety locomotives at a cost of £560,213. The firms, and their proportions of the total, are as follows:—Krupp, twenty-six at £5770 each—£150,020; Line-Hofman, five at £6000 each—£30,000; Henschel & Sohn, twenty-eight at £6935 each—£194,180; ditto six at £6785 each—£40,710; ditto fourteen at £5270 each—£73,780; Hohenzollern Loco. Works, six at £6370 each—£38,220; Berliner Maschinenbau, four at £6242 each—£24,968. Tenders were received from Great Britain, America, Germany, and Italy. The technical advisers to the Administration, the Tender Board, the General Manager and the Railway Board were unanimous in their advice to the Minister of Railways and Harbours to accept the tenders from the German firms. It is stated that the Administration has given the fullest consideration to the various proposals submitted by the tenderers, and has taken into account the various conditions governing the respective tenders, the quality of the material and the workmanship of the locomotives. Some time ago the Government invited tenders for the construction of 165 locomotives, but subsequent to the receipt of tenders it was decided to reduce the number of Garratt G type engines by thirty-six. The ninety locomotives accepted were among those tendered for. Orders for the requisite spares for these ninety locomotives have been placed at a cost of £140,000. Of the 165 locomotives originally asked for, fresh tenders have now been invited by the Administration for the supply of thirty-nine of the "15 C" class. This class has so far been mainly, if not entirely, obtained from Britain, and the engines are stated by the "men on the footplate" to be second to none, not even the latest engines, about which so much fuss has been made. These tenders were returnable by January 3rd, last. With regard to the orders given earlier, representatives of British and American makers who tendered admit that the orders could not, on the prices, have been placed other than they have been. The British representatives quite candidly state that the German firms supply excellent locomotives, and that their prices were 28 per cent. below those quoted by their own (British) firms, but both the British and American representatives declare that they are absolutely certain that the German firms have taken the orders at under cost price in order to keep their works going. The facts remain, however, that Germany has consolidated her position, and that her firms have gained the kudos that used to belong to British manufacturers. The Germans have also supplied all the experimental engines; the great 186-ton loco. for heavy traffic, the Diesel type engine, and so on, and success of these experimental engines in service would mean that the firms that supplied them would obtain orders for so many of them that, in the aggregate, they would exceed any orders previously given by the Union, and that no British firms would have any chance.

Gold Output for the Year.

There is every likelihood that the gold output for the year 1927 will have exceeded 10,000,000 fine ounces, the eleven months' total having reached 9,279,405 oz., as compared with 9,126,695 oz. in the corresponding period of

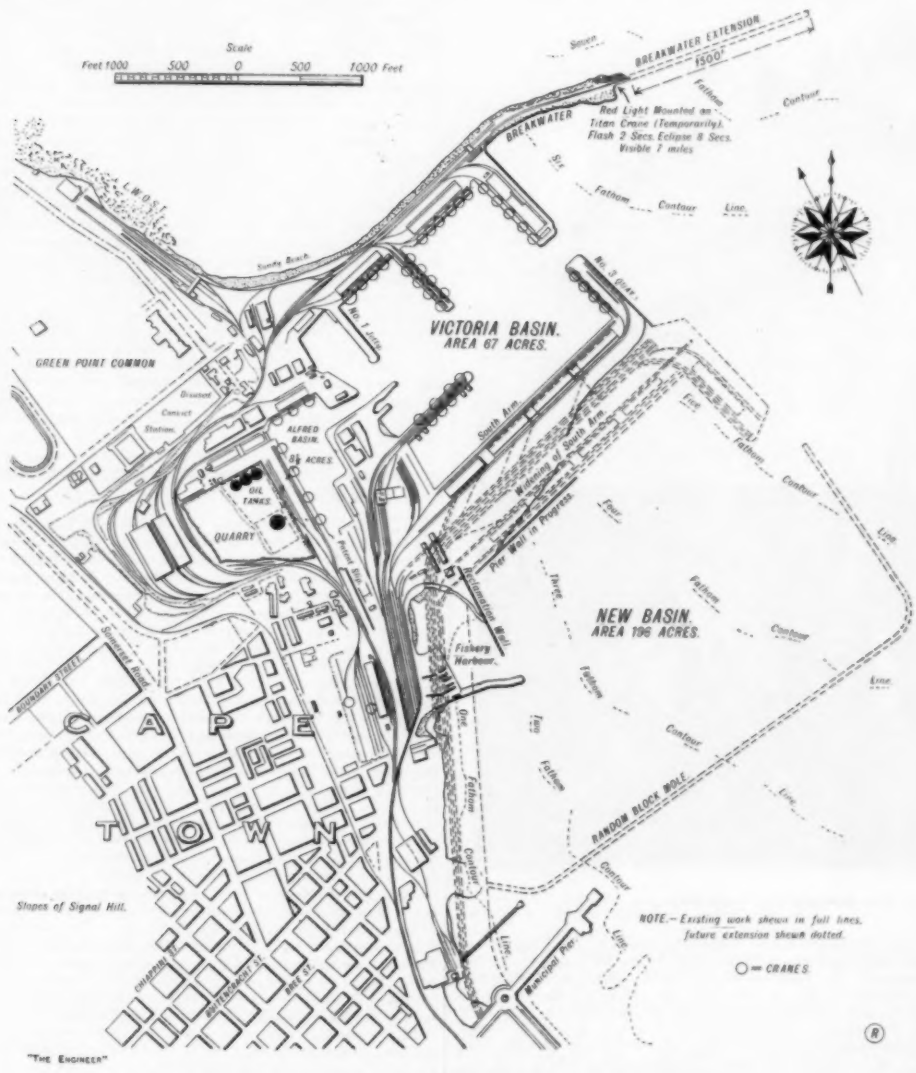
1926. For the present year the grade averaged 6·714 dwts. per ton, as compared with 6·542 dwts. in eleven months of 1926. The Witwatersrand grade improved from 6·493 dwts. to 6·612 dwts., while that of the "outside district" showed a still more remarkable improvement, from 10·218 dwts. to 12·750 dwts. This latter improvement was entirely due to the great increase in the grade of ore milled at the Sub-Nigel mine, as the result of the policy of cleaner mining. Working revenue averaged 28s. 7d. per ton, an improvement of 9d. per ton as compared with the previous year, but it was practically offset by an increase of 8d. per ton in working costs, which averaged 19s. 9d. for the Transvaal mines during the year (19s. 6d. for the Witwatersrand). Working revenue for eleven months totalled £38,887,078, as against £38,221,390 last year. There was, however, a decrease in milling tonnage, which up to the end of November totalled 27,170,677, a decrease of 25,500 tons. Working profit for the last year averaged 8s. 10d. per ton, as against 8s. 9d. per ton in 1926 on the whole of the Transvaal mines, though on the Witwatersrand the profit fell by 1d. per ton to 8s. 8d. On the other hand, the "outside district" showed the extremely satisfactory figure of 21s. per ton milled, as against 10s. 10d. in 1926.

Doubling Cape Town Docks.

Two thousand workmen are now engaged in the work of doubling the size of the Cape Town docks, and they are assisted by hundreds of tons of machinery. The new basin will have an area of 196 acres, and the South Arm of the existing docks, which has been widened to an extent of 700ft. along the whole 2400ft. of its length, will form one side of it, a new quay flanking its reclaimed area. From a point much further inland of the bay, so much so that it is almost at the foot of the city's most important street, a mole constructed of random blocks of concrete is being run out to a distance of 5600ft. The new quay and the mole have arms running towards each other, the space between their ends being the entrance to the basin. The berth at the return arm of the new quay will be the deepest berth in the docks, the depth of water being over 40ft. On the seaward side of the docks the existing breakwater is being carried 1500ft. further out. Divers are hard at work, and before the end of last year they had laid the sea bed with 40-ton concrete blocks for a distance of 410ft. The Titan crane renders great service, but the work is naturally slow. An average addition of 30ft. a month was achieved during last year. By 1930 it is hoped that the breakwater will be ready. The output of blocks required is, of course, large. Up to the middle of December 200,000 tons of concrete blocks had been made for the dock extensions. For the mole alone, excluding the breakwater, 80,000 blocks, each over 6 tons in weight, have to be made. Up to the present well over 1,500,000 tons of rubble and soil have been brought from the Cape Flats and used in the reclamation. Six train loads arrive daily at the docks. They carry some 45,000 tons a month. The contents are tipped into the sea, and the new wharves and traffic arteries grow. It was expected that in January a spacious new shed on the South Arm would be completed. Its capacity is 14,660 tons. The shed is double storeyed. On the upper floor two runway skids will operate at any point to lift cargo and lower it on to the roadway. Over the quayside a platform balcony extends along the whole length of the store. The cranes will be able to lift cargo straight from the holds of the ships on to the balcony, and a number of sliding doors give access to the upper store. These sheds will be built right down the South Arm in such a way that the upper stores will be continuous. These stores will have a capacity of 45,000 tons, each ton representing 57 cubic feet. Similar sheds are to be built on the New Quay and the Return Arm of the quay. Cape Town docks will then be able to store considerably over 100,000 tons more than at present. The new basin will have five new berthing quays.

British Motor Omnibuses.

British motor omnibuses continue to maintain their supremacy in South Africa, the proportion being certainly as high as eight British vehicles to one foreign. The Cape Town Tramway Company recently placed on the road five Leyland Lion omnibuses, each capable of seating thirty-six passengers. A White omnibus, to seat thirty passengers, is approaching completion. The bodies were all built in the company's workshops at Cape Town. Arrangements are being made by the company to increase its fleet by a further ten vehicles as soon as the chassis can be obtained. The building of the bodies in South Africa means a saving of 10 to 15 per cent.—according to whether the price is above or below certain limits—compared with importing the entire omnibus. Ten heavy duty 5-ton chassis for the Railway Road Motor service were, at the time of writing, expected from Britain. They will be fitted with bodies suitable for the longer and heavier lines to the Administration's own design. These chassis are 27½ft. long, and on them will be built the heaviest omnibuses at present working in South Africa. These chassis are all "Karrier" make. Many more omnibuses for road motor service will be required by the Railway Administration, which is opening new routes at the rate of quite 150 miles per month. The few American makes seen on the streets at Johannesburg, Durban, and Cape Town comprise Reo's, International and Federal-Knight. There may be an odd one or so of some other make.



PLAN OF CAPE TOWN SHOWING THE HARBOUR EXTENSIONS

It is proposed to build a bridge across the Aangerman River, in the north of Sweden, which, when complete, will, it is said, be the biggest of its kind in Europe. The design is a suspension bridge, 268 m. long, suspended 40 m. above the river, and the estimated cost is £767,000 (approximately).

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

General Situation.

THOUGH a gradual recovery in the basic industries of the Midlands and Staffordshire is generally foreseen, and the iron and steel market tone is moderately bright, the business being done at date is considerably below normal. Alike in iron and steel, raw and finished, orders are frequent, but they are for small tonnages, and producers are compelled to keep down output. It is satisfactory, however, to discover that, in some departments, we are wresting from the foreigner business which rightly belongs to us, and the tendency in this respect is for native material, owing to advancing foreign prices, to become more attractive to British engineers and manufacturers. Midland iron and steel masters are anxious to increase production, but consumptive demand does not warrant it. The engineering industry appears to be slowly improving throughout the South Staffordshire area, and Midland manufacturers are expecting weighty contracts as the result of the British Industries Fair. The improved demand for galvanised sheets, with a consequent raising of prices, was the most marked feature of the week.

Steel.

It is difficult to gauge the effect of the price increase declared by steelmakers, having for its object the penalising of those users of British steel who continue to buy from the Continent. Members of the Association say that there is already a considerable displacement of imported steel by the home production. Constructional business is reaching Midland mills in small quantities, generally ordered at short notice. It is seldom that an order for constructional steel exceeds 500 tons. The northern districts compete keenly for all the available business. They have the advantage of shipbuilding and rail orders, and are understood to be working at 70 to 80 per cent. capacity, whereas in this district 60 per cent. is about the average. The orders for rolling stock material supplement very usefully those for constructional steel, and a valuable asset is the ability to supply orders at short notice. In addition to rolling stock, such trades as the chain, anchor and engineering industries are calling for fair supplies of material. There is a remarkable falling off in the use of foreign steel as the result of the rise in price, but semis continue to arrive in this district in considerable quantities. New contracts are not being placed at the same rate, so far as observation goes. Consumers hesitate to commit themselves so far in advance as the exigencies of the import trade now demand. It was reported on 'Change in Birmingham to-day that a large number of Welsh bars have been bought by the sheet and tin-plate rollers of South Wales, replacing foreign material ordered somewhat heavily a month or two ago. Continental billets now cost £5 12s. 6d., against native makers' price of £5 17s. 6d. to £6. The former figure is considered to be acceptable for re-rolling, and some weighty speculative orders are reported to have been placed by Birmingham merchants. Foreign finished bars at £6 7s. 6d., strip at £6 15s., and sheet bars at £5 15s. have little sale. No great quantity of new business is being given to continental houses for bright drawn steel, the price of which is not now attractive. Moreover, very satisfactory supplies are obtained from mills a few miles out of Birmingham. The tube works are using an increasing proportion of Staffordshire material.

Raw Iron.

Pig iron remains a disappointing feature of the market. Only small-scale business is being done. But, though there is no perceptible broadening of demand, prices remain very steady. Midland smelters will not entertain offers and quote firm at £3 for Northamptonshire, £3 4s. for Derbyshire, and £3 3s. 6d. for North Staffordshire foundry grades at furnaces. The restricted output of the furnaces is being disposed of. Makers of high-class castings, in addition to their Midland purchases, are taking hematite from the East and West Coasts for mixing purposes. Continental pig iron has long since been beaten out of the Midland market. There have been more inquiries for forge pig. That is a department of the market which has shrunk to such small proportions, however, that even an inconsiderable movement attracts attention. Many smelters in this area are of opinion that the position will show improvement in the near future. Their view is that some, at least, of the causes which have brought about the closing down of furnaces during the past eight or nine months are losing force, and that, given time, the situation will right itself. At the moment pig iron production permits of little profit, but it is impossible with demand at so low an ebb to improve upon present selling prices.

Finished Iron.

The better tone lately reported in the finished iron trade has not been reinforced. Current transactions are not sufficient to give regular employment to the bar mills, and specifications against contracts are somewhat unsteady. Marked bars remain at the £12 10s. basis. Railway contracts are calling for moderately good tonnages of high-grade bars. Increased activity in the shipping industry has benefited the cable section, and it is anticipated that this will continue for a considerable time. Some of the chain makers have sufficient orders on hand to keep them busy for something like six months. Specifications are not reaching the bar mills, however, as freely as would be expected under the circumstances. A certain volume of foreign chain is coming through, but the British product still holds its own. The general engineering demand for wrought iron, if it has improved at all, has not improved much. Continental products of inferior grade are still finding buyers on account of the difference in price. No. 3 Belgian iron for the nut and bolt and

fencing industries has advanced a further 2s. 6d. to £6 7s. 6d. delivered, but Staffordshire bars at £9 still cannot compete. Tube strip sells fairly readily at £11 10s. per ton.

Galvanised Sheet Revival.

Something in the nature of a revival has set in in the galvanised sheet department. The quickened demand reported last week has been further stimulated, and a large part of the output of the mills between now and the end of March is sold. Many mills are well booked for April, and additional inquiries are received daily. Most of the overseas buyers show keen interest, Calcutta and Bombay being especially prominent. Birmingham merchants shipping to various parts of the world generally find it necessary to include parcels of galvanised sheets. The spring trade in this department has every appearance of being substantial. Prices of galvanised corrugated sheets of 24 gauge, which advanced sharply last week, have appreciated a further half-crown, most of the manufacturers now demanding £13 7s. 6d. at least for their output. With delivery dates receding and values hardening, buyers have this week shown greater anxiety to cover.

Scrap.

This week has witnessed some falling off in the demand for scrap. But South Wales has been a good customer of late, consuming a good deal of this material for the production of sheet and tin bars, and stocks are not so heavy as they were a few weeks ago. Heavy steel scrap is quoted £3 delivered South Wales, but it is considered an offer slightly below this figure would be accepted.

Birmingham and Carbonisation.

The Corporation of Birmingham has taken a very definite lead in the solution of problems associated with the gas industry of the country, and the use of by-products, and it was fitting that it should be the venue of the Conference organised under the auspices of the Joint Fuel Committee to discuss the possibilities arising out of the carbonisation of coal. Birmingham is the only place in the country where there are facilities for carrying out full-scale experiments in such directions as the production of blue and carburetted water gas in continuous vertical retorts. Two or three other municipalities have made efforts in the same direction, but in the scope and energy of its pioneering work Birmingham is well to the fore. This important matter of a coal-testing department, which has a vital bearing upon the experiments concerning the carbonisation of coal and its ultimate possibilities, was established in Birmingham twenty years ago. There are no more than three stations of the kind in the whole world.

Competition and Taxation.

Prices in the rolling stock industry at the moment are very low, and to that cause alone is attributed the reduction from the previous year of £10,000 in profits made during the year 1927 by the Birmingham Railway Carriage and Wagon Company, Ltd. Mr. Alfred R. Windle, chairman of the company, at the annual meeting, stated that he never remembered competition as severe as it was to-day, with the result that contracts for new rolling stock had often been entered into at entirely unremunerative figures. He also emphasised the necessity for some relief from the heavy burden of taxation which British industry has to bear, particularly trades dependent to so large an extent on export business. "We are handicapped on this account," he said, "to an almost insuperable extent in the struggle against foreign competition to retain our existing markets, or to develop new ones. Industrial concerns should eschew all politics, but economy in national and municipal expenditure is so vital to their well-being that we are compelled to press this matter on any Government then in office." It is pleasing to note that the company, which had a successful year despite trying circumstances, has a very fair number of orders on its books at the moment, and is hopeful of adding to them.

Coventry Engineering.

There are now improved signs of activity in the motor engineering establishments of Coventry and district, and a steady demand is anticipated from now on for motor cars of pleasure types. The manufacture of motor coaches, and also of the public passenger-carrying vehicle of smaller capacity, is providing sufficient work to keep the commercial vehicle firms busy, and there is a fair inquiry for motor omnibuses for municipal and other services. The industry cannot be said to have yet got into its stride, but it has got off the mark.

More Pits Closing.

Following the recent permanent cessation of activities at the Lilleshall Company's Freehold Pits, coupled with the closing down on Saturday last of the Grange and Granville Pits and the displacement of 500 miners, comes the news that another department of the company's work at Priorslee, Salop, will cease operations at the end of this month. This is the coal-distillation plant, which is known as the by-product department, and which employs about 120 men. The continued stagnation of the coal trade is given as the chief, if not the sole, reason for this deplorable situation.

Miners' Wages.

The wages of the miners in the Cannock Chase and Pelsall coalfield for March, which are based on the results of the working of the local coal industry during the months of November, December and January, will remain for the ninth consecutive month at the minimum of 42 per cent. on basis rates. The minimum wage for stallmen will be 9s. 4d. per shift, loaders 8s. 4d., and surface workers 6s. 8d. The real ability of the owners to pay, which is only 11·54 per cent., is an improvement on the figure of 7·86 per cent. of a month ago. The loss per ton of coal raised, which in December was 9·32d., was reduced to 0·93d. in January. The accumulated deficit is now stated to be £1,283,330, compared with £1,116,305 at the end of January and £928,764 at the end of December.

Unemployment.

A further decline of 2055 in the number of unemployed in the Midlands brings the current total down to 138,938. A few more substantial falls such as this would be gladly welcomed. Unfortunately, the latest returns show that in some towns labour is still being displaced, the number of workless having grown, though only in small measure, in Bilston, Coventry, Cradley Heath, Leicester and Redditch.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Back to Switzerland.

By taking the unusual step at a meeting this week of rescinding a resolution of February 15th which, in turn, rescinded an original resolution of February 1st, the Stockport Town Council, it may reasonably be inferred, has now finally made up its mind as to the destination of a contract for a 20,000 kilowatt turbine set for the Electricity Department. At the first meeting the tender of £35,151 submitted by the Swiss firm of Escher Wyss and Co. was accepted, the lowest figure received from a British maker being £52,000. Later, this latter tender was reduced by £10,000, and it was this reduction which resulted in the second meeting of the series, at which it was decided to rescind the resolution accepting the Swiss tender, and to issue fresh invitations for tenders to a specification to be drawn up by the electrical engineer and approved by the Electricity Committee. At a further special meeting of the Town Council on Monday of this week, it was again decided to accept the tender of Escher Wyss and Co., though only by a majority of one. A lengthy full-dress discussion took place, but apart from further criticism from many quarters of British electrical engineering firms, no new facts emerged, and presumably the matter may now be regarded as closed.

Explosion Inquiry Closes.

The official inquiry into the explosion at the Bradford-road gasworks of the Manchester Corporation last August, which resulted in the destruction of two gasholders, has been concluded. Mr. F. O. Stanford, who conducted the inquiry on behalf of the Ministry of Health, explained that since the previous hearing he had submitted samples of metal from the gasholders to the National Physical Laboratory for examination. The results of the tests were a little lower than those found by Mr. E. L. Rhead, of the Metallurgical Department of the Manchester College of Technology, but Mr. Stanford pointed out that the samples which he himself had chosen were deliberately selected from weak metal, while the tests that had been carried out by Mr. Rhead were applied to average samples of the metal. A request was made to the Gas Committee of the Corporation by the inspector that when the ironwork of the wrecked gasholders was dismantled, the work should be done carefully so that such things as the inner rollers and their guides could be carefully examined. Leeds City gas engineer (Mr. C. S. Shapley), who was one of the expert witnesses at the resumed hearing, said he was satisfied that the holders did not explode, although the occurrence had been described as an explosion. There appeared to have been an accident of some nature, and the gas escaping from the holders caught fire. He accepted the explanation of Mr. W. Newbigging, consulting gas engineer to the Manchester Corporation, that the trussed roofing had collapsed. Externally, he had noticed, the crown plates of the holders seemed to be extraordinarily good on cursory examination, but internally the metal showed signs of fatigue.

Cheaper Current in Salford.

Salford Electricity Committee has decided to recommend the City Council to sanction an average reduction of approximately 10 per cent. in the charges for electricity for domestic lighting and heating and power, including that supplied to the tramways department. The fact that the Committee is in a position to make the suggestion is attributed officially to the economical working of the electricity undertaking as a whole, and more particularly to the very satisfactory results that have been achieved at the new Agecroft Power Station.

Coal Marketing.

Lancashire and Cheshire coalowners, to the extent of 90 per cent. of their number, have agreed to co-operate in the coal-marketing scheme, and committees have been appointed to act with a central body—the Lancashire and Cheshire District Collieries' Commercial Association—which will operate the scheme.

Receiver Appointed.

On behalf of the debenture holders, Mr. Hindle, the secretary of the company, has been appointed receiver and manager of Haighs (Oldham), Ltd., engineers, Globe Works, Oldham. The necessary application was made in the Manchester Chancery Court this week.

Ribble Bridge Scheme.

On the ground that the scheme had not been sufficiently developed to warrant definite decisions being taken in the matter, the Lytham St. Annes Council, at a meeting on Monday, passed a resolution regretting its inability to express any opinion regarding the project for constructing a bridge, on the "railplane" system, over the estuary of the river Ribble from points adjacent to Southport and Lytham. More detailed reference to the proposal was made in this letter a week or so ago.

Non-ferrous Metals.

So far as prices are concerned, experience during the past week has been healthier in pretty well every section of the non-ferrous metals market than in the previous week. Copper is the one exception. Standard brands of this metal have lost some ground, although not to an important extent, while the loss in the case of refined descriptions has been almost negligible. For the most part, demand in this section has been rather quiet, with however, rather more buying interest being displayed at the cheaper rates. On a somewhat freer inquiry for tin a steadier tone has been in evidence, and prices have registered a recovery, current quotations now being back to where they were a fortnight ago. It is possible that, for the time being, values in this section of the market have about touched bottom; certainly, the market view of the outlook seems to be rather more hopeful than it has been for some weeks. A slight recovery has also to be recorded in respect of lead, due to a slight expansion in the demand from consuming interests at the relatively low prices that have lately been ruling. Spelter is fractionally dearer than at last report, the galvanising trades having been buying on a somewhat bigger scale. It is still the case, however, that supplies of this metal in sight seem to be more than sufficient to meet prospective needs.

Iron.

The buying of pig iron this week by Lancashire consumers generally has been on a disappointing scale, and there appears to be a more widely held feeling that no substantial improvement in the situation can be looked for until there is a great degree of activity in the local engineering trades. The fact must not be overlooked that many branches of engineering in this part of the country depend in a large measure upon the state of affairs in the cotton textile industry, the plight of which seems to be no better now than at any time during the last few years. Meanwhile, except for continued reports of undercutting here and there, quotations keep fairly steady, Midland makes for delivery to Marchester or equal are offered this week at between 72s. and 72s. 6d. per ton for Derbyshire and 71s. 6d. for Staffordshire, with North-East Coast iron at 78s., Scottish at 86s. and upwards, and West Coast hematite at from 84s. to 85s., all delivered into this district. There has been no apparent improvement in the position of manufactured iron, and the demand is much below capacity, most of the establishments working no more than an average of about three days a week. Prices are unchanged at £10 per ton for Lancashire Crown bars, and £9 10s. for second quality material.

Steel.

Although there has been little actual expansion of buying interest in the steel market here since my last report, sellers are inclined to take a less pessimistic view of the situation. The higher prices that are being asked for imported steel and the longer periods that are now being taken to effect deliveries from continental works, coupled with the increased rebate to users of British steel, are factors which before long, it is hoped, will influence the demand for the home-produced products. For the most part, however, buying on this market is largely of a hand-to-mouth character, with users looking askance at forward contracts. Joists and sections are quoted at £7 17s. 6d. per ton, tank plates at £8 12s. 6d., boiler plates at £9 15s. to £10 5s., according to quality, and large steel bars at £8 17s. 6d. About £7 10s. per ton seems to be the best prices that re-rollers can command for small bars, and inquiry in this section of the market is at a low ebb. The demand for continental steel is slow, but the firm tendency of prices continues, although there has not been much further change since last week. For delivery to works in this district, for cash against documents, sections are quoted at £5 17s. 6d. to £6 per ton, Thomas plates at £7 5s., Siemens plates at £7 15s., angles at £6 10s., billets at £5 7s. 6d., and sheet bars at £5 10s. per ton.

Engineering Firm's Trade with Russia.

In his speech at the annual meeting of shareholders in Mather and Platt, Ltd., Mr. Loris E. Mather said that all contracts entered into with Russian customers had been carried through without any trouble and in all cases payment had been made when due. Political differences had, however, prevented further contracts being entered into during the past twelve months, and that had no small effect on the profits and employment of makers of textile machinery. They anxiously looked forward to a renewal of trade relationships with the Soviet, which could not fail to be to the mutual advantage of both parties. With that in view they had sent a technical representative again to Moscow. With regard to home trade, Mr. Mather said that contracts had not infrequently been placed abroad during recent years, to the loss of British manufacturers and to the detriment of the workers, while at the same time there had been an increasing burden of rates and taxes. Wages and taxation were lower on the Continent than in this country, and it was from Europe that the greatest competition had to be faced. He asked, "Did our public authorities give sufficient consideration to these facts when comparing British tenders with those of their rivals abroad?"

A Prosperous Engineering Firm.

The annual meeting of the shareholders in the National Gas Engine Company, Ltd., held on Tuesday last, was presided over by Sir Dugald Clerk, director, in the absence, through illness, of Mr. H. N. Bickerton. Sir Dugald said the balance sheet was the best the directors had presented for the last few years, and it was regarded as the forerunner of a return to prosperity. During the first six months, he stated, business did not come up to expectations, but that was compensated by a large contract for crankless engines for the Australian gas companies. Referring to the general outlook for the internal combustion engine, Sir Dugald said that the economic changes which had followed the war had caused the cost of coal, anthracite and coke to rise. That had affected the cost per heat unit of town's gas and producer gas. In order to compete advantageously with electric generation in central stations, it had become necessary to provide engines using heavy oil in the most economical manner. That the National Company had done in the form of a

heavy-oil cold-starting engine, which had proved very successful, both at home and abroad, in many sizes. Large numbers of such engines of from 10 to 600 horse-power had been manufactured. It had been found that engines capable of using either oil or gaseous fuel were much wanted in countries where carbonaceous waste products were produced, and combined oil or gaseous fuel engines were now in considerable demand. The slackness of the iron and steel industry had reduced the demand for blast-furnace engines, but that market would revive as the industry improved. Already a demand was springing up for engines to run on coke oven gas. Formerly that field was difficult, because of the high-temperature flame, which was damped down by cooled exhaust gas. In recent engines that difficulty had been entirely overcome.

BARROW-IN-FURNESS.

Hematite.

There is still a pronounced quietness in the West Coast hematite pig iron trade, and as evidence of it, one can point to the fact that stocks are not coming down at anything like the rate they should do. In some works, where production still continues, there is even a tendency for stocks to increase. That is a bad sign, in view of the fact that steel departments are taking a quantity of iron. Business is confined to small tonnage, which is owing largely to moderate requirements on the part of customers in Scotland and the Midlands. A little more has gone to South Wales, but it is nothing to speak about. There does not seem, at the moment, to be any sign of an improvement, and should the steel departments become less busy we shall most certainly see a reduction in the number of furnaces that are at present in blast. American trade seems to be noticeable by its absence. The continental trade is very dull, but as prices have increased on the Continent, West Coast makers are able to compete. The iron ore trade is moderately employed in view of the number of furnaces which are in blast locally, and there is not much tonnage coming into the district. Foreign ore is in quiet demand. The steel trade is fairly well employed at the moment, but fresh orders would be very welcome. Business in hoops is good and likely to continue to be so.

Shipbuilding.

The order for a destroyer which the Vickers-Armstrong combination has secured for the Barrow yard is interesting, in so far as it is some years since a vessel of that type has been built locally, though many years ago the Naval Construction Works at Barrow gained quite a good name for turning out this class of craft. The Admiralty orders which are held at Barrow at the moment consist of a repair ship, a submarine tender, both of which will be about 600ft. long, and will be driven by twin sets of internal-combustion engines of the M.A.N. type; four submarines of the "P" class, and the destroyer just mentioned.

SHEFFIELD.

(From our own Correspondent.)

Position and Outlook.

IT is impossible yet to write anything of a very cheering character with regard to the actual position of the steel trade in this district. On the contrary, whatever the future may have in store, present conditions show a downward tendency. Many firms experienced a steady expansion of orders from about the middle of January, but the movement appears to have met with a check. There is a falling-off of activity in all the more important departments, this remark applying more to the home than to the export trade. At the rolling mills, bookings are reported to have declined. On the other hand, the manufacture of specialities, such as machines and material which are required by the newer and more progressive industries, keeps pretty brisk. There is a good demand for springs and parts for commercial motors, but builders of touring cars are not ordering their average quantity of Sheffield material. The outlook for most branches of the steel trade is considered favourable. A good deal of confidence is based on the rise in continental prices. There have been several reports this week of foreign quotations which did not compete with those of British makers, as a consequence of which business is remaining at home. It is believed that a great amount of work is in prospect, and that contracts which have recently been agreed to will call for a considerable amount of Sheffield steel in various forms.

Naval and Railway Work.

The placing of orders for destroyers by the Admiralty last week was of interest to Sheffield, as two of the local firms are to participate in the work. These are Vickers-Armstrong, who are to build one of the vessels, and John Brown and Co., Ltd., who have received orders for two. The vessels will, of course, be built on the coast, but Sheffield should benefit from the making of the steel parts, armaments, guns, &c. It is expected that the city will also, as usual, be called upon to supply steel for the vessels which are to be built by other firms. The railway material branch of the steel trade is fairly well employed, although some of the tire plants are short of work. Large orders for wagons, axles, tires and springs are now being distributed by South American and South African railway companies, and it is anticipated that a principal share of them will come to Sheffield. Owing to keen competition from Belgium, France and Germany, however, local makers are compelled to quote prices which leave little or no profit. A local railway order announced during the past week was one for twenty hopper ballast wagons, placed by the London and North-Eastern Railway Company with the Leeds Forge Company.

Cheap Cutlery in Request.

Conditions in the cutlery trade, with regard to ordinary lines of good quality, are unsatisfactory. Many firms are short of work, and are faced with severely cut prices, and only in exceptional cases can a good order book be found. There is, however, one really busy line—that devoted to the making of articles for the sixpenny bazaars. These establishments are rapidly growing in number, and are bringing about an increasing demand for cheap stainless knives, fish eaters, butter knives, and various other small plated articles and household tools. Contracts which have been placed for such goods recently are said to embrace millions of articles. Quotations for spoons and forks, which are presumably to be distributed for advertising purposes, are being asked for by a firm of tea merchants in Canada. Tenders are also being invited by the British Admiralty for best plated hollow-ware.

Benefit of Safeguarding Duty.

The Sheffield Cutlery Manufacturers' Association has issued a detailed reply to a pamphlet on "Burdens of Industry," which was published by the Liberal Council in December last. The Council endeavoured to show that the safeguarding duty had been of no benefit to the cutlery trade, but the manufacturers put forward an opposite view. They show that since the imposition of the duty the trade has passed through a very difficult period, including the general strike of 1926; that there were very large imports of foreign cutlery in anticipation of the duty, and that the duty has been evaded by importers. They state that the returns of output and employment sent in to the Association's secretary show an increase in sales for 1927, as compared with 1926, of approximately 10 per cent. They add that: "When the large stocks imported in December, 1925, have been finally disposed of, and when a further tightening of the net by the Customs authorities has taken place, it is fully anticipated that the increase in the turnover of the cutlery trade will be many times the percentage just stated. Further, the cutlery manufacturers consider that the granting of an order under the Merchandise Marks Act, 1926, requiring that all cutlery prior to importation shall be indelibly die-stamped with a mark of origin, will benefit the trade even more than the duty at present in operation."

High Prices for Razor Blades.

Another interesting paragraph in the statement of the Cutlery Manufacturers' Association refers to safety razor blades, and in particular to a Sheffield company which entered into the manufacture of these articles extensively and has recently gone into liquidation. The Association says that the liquidator informs it that the liquidation was caused not through the company's failure to manufacture and sell razor blades in substantial quantities both at home and abroad, but was occasioned primarily by imperfect financial arrangements at the inception of the company. He also informs it that not an ounce of Belgian steel was ever used in the manufacture of the company's blades, which were manufactured wholly from its own special steel made at its own melting works in Sheffield. "The liquidator informs us," it is added, "that he is carrying on the business of this company and is at present selling substantial quantities in the home and foreign markets, as well as very considerable quantities in the United States of America at a retail price, at least 50 per cent. higher than Gillettes, and that steps are being taken which it is expected will result in due course in the termination of the liquidation proceedings and in the company resuming its trading operations in the normal way."

Large Electrical Contracts.

Large extensions of electrical plant are being carried out by the Leeds and Hull Corporations, and the acceptance of important tenders is recommended. At Leeds the Electricity Committee recommends that the work of equipping the new super-power station at Kirkstall shall be given to the British Thomson-Houston Company, Ltd., of Rugby. The plant to be installed includes two turbo-alternators running at 3000 r.p.m., each being capable of an output of 25,000 kW in the form of three-phase current at 11,000 volts. A notable feature for such large units is the high speed adopted. Further, the turbines are designed on the double-cylinder principle, so as to utilise to the greatest possible extent the energy in the steam at the high pressure of 450 lb. per square inch. The contract price is £176,504. The British Thomson-Houston Company was faced with strenuous continental competition, and the fact that it secured the contract, although it was not the lowest tenderer, is a notable success for British engineering. At Hull the Electricity Committee has accepted the tender of Clarke, Chapman and Co., Ltd., Gateshead, for five water-tube boilers and accessories, at £168,279; that of Heenan and Froude, Ltd., Manchester, for boiler-house steel structure, at £79,055; and that of Spencers, Ltd., Melksham, for coal and ash-handling plant, at £20,192.

A Dry-cleaning Plant for Coal.

An interesting item of colliery equipment news is the installation of a dry-cleaning plant for coal, to supersede the washer at Thorne Colliery. The plant will be worked by electricity and the coal will be cleaned by currents of air instead of water. There will be a consequent saving of coal dust, as practically every particle will be preserved, which is not the case with a washer. Two new boilers are to be laid down to consume the coal dust.

A Launch at Selby.

A large steel screw fishing vessel, constructed for the port of Grimsby, was launched at the Ouse shipbuilding yard of Cochrane and Sons, Ltd., Selby, on Saturday. The vessel is 138ft. 4in. long, 23ft. 9in. broad, and 13ft. 6in. moulded depth.

A Railway Disappointment.

There is disappointment in North Lincolnshire at the failure of hopes which have been entertained of improved railway facilities. Recently several local authorities petitioned the Ministry of Transport to urge the London and North-Eastern Railway Company to complete the Barton to Winteringham light railway, in order to give better facilities and also as a means of providing employment. The Ministry has now written to the Brigg Rural Council, enclosing a letter from the railway company, which states that it has given the matter every consideration, but cannot see its way to proceed with the work.

NORTH OF ENGLAND.

(From our own Correspondent.)

The Trade Outlook.

A QUITE optimistic feeling pervades the iron and steel industry in the North of England just now. It has been engendered not only by renewed market activity, but by the fact that producers in this area have now got to real grips with foreign manufacturers in the bid for home and overseas business. Developments on the Continent have diverted orders to this district, and business with firms that have not purchased North of England products for years past because of the comparatively cheap figures at which they have been able to purchase foreign materials has been reopened. Buying of continental iron for consumption on the North-East Coast has, in fact, virtually ceased, as prices are now higher than those of local products, and imports in fulfilment of contracts arranged some little time ago have shrunk to very small proportions. Moreover, Cleveland iron makers are successfully competing for trade in France and Belgium. Slow but steady improvement characterises the shipbuilding and engineering trades, but the difficulties attending the efforts to restore the lost fortunes of the coal industry are as perplexing as ever. It will be recalled that after the general stoppage of 1926, the colliery owners asked for higher production and longer working hours so as to reduce costs and capture trade. They got both. The seven-hour day became eight, men worked on Saturday and the output per man improved. The outcome was a plethora of coal which was offered for export in fierce competition with foreign products at prices which involved heavy losses to the pits and ultimately, through the court of arbitration, a big sacrifice to the miners in wages. And the general position is no better. Prices for nearly all grades of coal have been mutually agreed to by the collieries, but the consumer abroad contends that they are too high, and shows little interest in the market. Some producers hold to the view that the only remedy is to limit production to the demand and adhere to a definite price—which is the opposite dictum to high production, low costs and low prices.

Contracts for Locomotives.

Robert Stephenson and Co., Ltd., of Darlington, have secured orders from the Crown Agents for the Colonies for eleven engines—five of the 2-4-6 type bogie tank engines for the Ceylon railways; and six 4-8-0 type tank engines for the Nigerian Railways. The firm also has on hand orders for ten locomotives—five tank engines for the Ceylon Railways and five engines and tenders for the Tanganyika Railways, whilst another contract for ten engines for the Central Argentine Railways is now being completed. With the new contracts and the work in hand, the firm's works will be kept well employed over the greater part of the present year. Sir W. G. Armstrong, Whitworth and Co., Ltd., have received a contract from the Great Western Railway Company for the supply of fifty 0-6-2 type superheated tank locomotives.

Cleveland Iron Trade.

Business continues to expand on a very satisfactory scale, and that there is confidence in the future is emphasised by the desire of customers to negotiate for forward supplies at round about current rates. Sellers are prepared in many instances to entertain such offers, notwithstanding the prevailing opinion that prices are more likely to advance than otherwise, and quite a number of contracts for delivery over periods ahead are understood to have been put through. Continental competition is appreciably less keen than it has been, due to a variety of reasons. Foreign makers' working costs have advanced considerably, and are still rising, with the result that quotations continue to move upward, and labour unrest abroad is causing much anxiety. Imported pig iron is being less and less consumed in this area, and the use of it is expected to cease on the completion of contracts now running, as local iron is now no dearer than foreign products. Output of Cleveland iron is now well behind the demand, and it is expected that additional furnaces will be put into operation in the near future. Prices are firm, No. 1 Cleveland foundry iron being 67s. 6d.; No. 3 G.M.B., 65s.; No. 4 foundry, 64s.; and No. 4 forge, 63s. 6d.

Hematite Pig Iron.

There is no appreciable change in the position of the East Coast hematite pig iron trade. A little more iron is being purchased, both for home use and for shipment to the Continent, but values realised keep well below cost of output, and there is room for much improvement in demand. Supply continues plentiful. Buyers, as a rule, stipulate for iron to special analysis, but recognised market rates are still ruled by the quotation for mixed numbers, which remains at 70s.

Ironmaking Materials.

Notwithstanding that sales are few and small, values of imported ores are very firm. Supply threatens to be far from plentiful, and recognised market rates are ruled by best Rubio at 21s. 9d. per ton c.i.f. Tees. Consumers of Durham blast-furnace coke are less disinclined to buy than they have been, but they still hesitate to enter into heavy contracts. Good average qualities are 18s. to 18s. 3d. delivered at the works, and the tendency is upwards.

Manufactured Iron and Steel.

Steady improvement continues in the manufactured iron and steel trade. Producers of some descriptions of finished steel are reported to have arranged a number of fairly good contracts, and there are inquiries circulating for a considerable tonnage of material. Buyers who come under the rebate scheme are now reaping the reward of their attitude in purchasing British products only. Semi-finished steel is also selling a little better, although in some cases prices of foreign commodities, while substantially advanced, are still below the rates named for the makes of this area.

The Coal Market.

Two large Scandinavian coal inquiries have excited the interest of the Northern market this week, and there is sure to be very keen competition for the business as between Polish and British fuel. The Swedish State Railways have invited tenders to be submitted by March 10th for the supply of 105,000 tons of best steams to be shipped over three consecutive months, commencing April; and the Danish State Railways require immediate offers for the supply of 60,000 tons of best steams to be delivered over a similar period. Poland is Northumberland's most formidable rival in Sweden both as regards quality and price. Most of the collieries are fairly well situated as regards prompt orders, but the forward outlook continues problematical. In Northumberland producers are holding out unfalteringly for the recently arranged minimum prices, but Durham does not appear to have got much beyond a nominal understanding not to recede from current values. For early shipment the prevailing prices are being paid, but there is no disposition to buy forward. Absence of forward contracting, however, will not cause anxiety if there is a sufficiency of prompt business. It is certainly putting a check to speculative buying, and that is of benefit to the industry. In second hands coals are selling at a shade under the direct quotations for steam and gas sorts, and as they dwindle in quantity the present more or less fixed prices may gain a greater measure of firmness. Best Northumberland steams are 13s. 6d. direct, and contractors offer at 13s. 3d. Other classes of steams are at late figures. It is difficult for some pits to sell some grades of steam smalls at present prices, while others are doing fairly well with smalls, but have a moderate trade for large at the prices asked. These are, of course, the inevitable drawbacks of any attempt to keep prices at a uniform line. There is no special development in the Durham gas coal trade. Business rules on steady lines at 15s. 3d. to 15s. 6d. for best qualities, and 13s. 3d. to 13s. 9d. for seconds. The bunker coal trade is well booked for best grades, and prices remain firm at 14s. to 15s., but ordinary kinds are plentiful and easy at 13s. 3d. to 13s. 9d. Gas coke is quiet, and fairly plentiful for February delivery at 22s. Patent oven cokes are in fairly good demand, but output is ample, and prices remain easy for ordinary at 17s. 9d. to 18s., and steady for special makes at 24s. to 25s., and beehive 25s. to 27s. 6d.

The Late Mr. G. L. Hutchinson.

The death, in his fifty-fourth year, is announced of Mr. George Lascelles Hutchinson, district manager for the Newcastle District of the Iron Trades Employers' Insurance Association, Ltd., since 1902. Mr. Hutchinson, before joining the "iron trades," was at the Liverpool Branch of the Ocean Accident Insurance Company for 2½ years. His loss is deeply felt, not only by his colleagues at the branch, but also by those at the head office of the company, where he was greatly esteemed.

SCOTLAND.

(From our own Correspondent.)

Steel Prices: Increased Rebate.

For obvious reasons, the announcement of an increased rebate on steel prices, equal to the recent increase in prices for home delivery, has met with a mixed reception. The announcement will, no doubt, be acceptable to buyers able to comply with the conditions, as they will still be able to purchase at the old figure, but it has yet to be demonstrated that an increase in business will follow. Buyers unable to adopt the scheme are now placed under an additional disadvantage, which may or may not deter them from purchasing in the home market.

Steel.

The upward trend of continental prices has created a more hopeful feeling among home makers who are now a little more confident that the disparity between home and continental prices will continue to decrease, and that ere long British products will be in a much more favourable position, both on home and export markets. Meanwhile, no appreciable expansion in business is noticeable. Heavy steel, in particular, is in need of fresh business.

Steel Sheets.

The demand for steel sheets is uneven. The heavy gauges are dull. Galvanised sheets are somewhat busier. Galvanised corrugated sheets are round about £13 per ton for 24 g. f.o.b. Glasgow, and black sheets, ¼in., £8 10s. f.o.b. Glasgow.

Iron.

Bar iron is inactive, and there seems little hope of an early improvement. Re-rolled steel bars also are unsatisfactory, and are further handicapped by increased prices of raw materials. Crown iron bars for export are approximately £10 and re-rolled steel bars £7 per ton.

Exports and Imports.

During the past week 12,500 tons of iron ore and 2650 tons of steel plates were unloaded at Glasgow harbour. Exports of steel and iron amounted to 3500 tons. Fairly large shipments of tubes and machinery were also dispatched.

Pig Iron.

There has been no increase in the demand for pig iron and supplies are still more than adequate despite restricted outputs. Prices are unchanged.

Scrap.

A moderate turnover in scrap at firm prices is reported. Heavy steel scrap is quoted about 62s. 6d., and heavy basic 58s. 6d.

Coal.

The depression in the coal trade has not decreased to any extent during the past week. Export demands grow scarcer, and despite a considerable curtailment of output supplies of almost all descriptions are more than adequate. Lanarkshire splints are still the feature of an otherwise dull market in which treble and double nuts are perhaps the weakest descriptions. Prices are unsteady, more especially in districts depending almost wholly on shipping orders. Aggregate shipments during the past week amounted to 246,324 tons, against 231,432 tons in the preceding week and 227,354 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

THE conditions in the steam coal trade have not varied very much during the past week, as compared with the position which has been ruling lately, but the probability of seeing any improvement in the near future is very remote. The tonnage position changes so suddenly that it is quite impossible to frame definite ideas as to prospects, but while market conditions this week have been deplorably quiet, and the inquiry for prompt supplies of coal has been scanty in the extreme, the fact remains that recent chartering of tonnage to load at South Wales ports has been moderately good and rather above the average since the end of last year. The total quantity of tonnage taken up for the week ended February 24th was just over 365,000 tons, which, however, compared with 447,000 tons for the previous week. Furthermore, better weather has lately prevailed, so that tonnage should come along more freely than has recently been the case. Still, although on the whole collieries may be able to get along very much on the lines prevailing lately, it cannot be denied that the current inquiry for coals is extremely dull and depressing. There are, of course, a few inquiries such as that of the Egyptian State Railways, for which tenders are to be opened at Cairo on March 6th, and news has come to hand that the Portuguese State Railways, which recently purchased 10,000 to 15,000 tons of small coals for early delivery, have now asked for prices for 100,000 tons for delivery over a period of three months. In this case the tenders have to be in on March 8th. The contract for 15,000 tons of patent fuel for the Algerian State Railways has unfortunately been lost, the business having been secured by French manufacturers. As regards the coal stabilisation scheme, there has been no fresh development. The date proposed for its coming into operation is March 19th, but no official statement on this point is so far forthcoming.

Colliery Companies' Troubles.

The financial position of many colliery undertakings must be an extremely difficult one, in view of the prolonged depression, but it is amazing with what equanimity serious events can be viewed by the market. Two well-known colliery companies which have recently been overtaken by financial troubles are the Great Western Colliery Company, Ltd., and the Lewis Merthyr undertaking. A few years ago no one would have dreamed of such possibilities, as both were in a sound condition and produced coals of such good quality that they were generally described as coals which sold themselves. In the case of the Great Western Company the announcement was made during the latter part of last week that the Powell Duffryn Company had made an offer to the shareholders to take over their liabilities on the basis of the exchange of one Powell Duffryn ordinary share for every five Great Western ordinary shares and four Powell Duffryn ordinary shares for every five Great Western preference shares. The Great Western Company's directors accepted this offer, and strongly recommended the shareholders to do the same. There was a meeting of the shareholders at Cardiff on Monday, when the position was fully explained to them, and in the end a resolution was passed that in view of the serious financial position of the company and the impossibility of raising the necessary capital, the offer of the Powell Duffryn Company should be accepted and all shareholders were recommended to adopt the same course. The offer of the Powell Duffryn Company represents a payment of £950,000 and means to the Great Western shareholders approximately 4s. for each of their £1 shares, these being in a company which a few years ago paid a dividend of 15 per cent. and gave a bonus of 40 per cent. The Great Western Company's property is estimated to contain 200,000,000 tons of fine steam coal, and has an estimated annual output capacity of 1,375,000 tons. The completion of this deal will mean that the Powell Duffryn Company will increase its normal output, at present amounting to over 6,000,000 tons mined from an area of 32,700 acres, to an output capacity of about 7½ million tons per annum mined from an acreage of about 38,000.

Docks Facilities.

The announcement was made at the end of last week by the Great Western Railway Company that as from Monday last vessels would be permitted to move from one South Wales port to another at the extra cost of a locking fee, but without incurring double dues. This applies to the ports of Newport, Cardiff, Penarth, Barry, Port Talbot and Swansea. The locking fee operates according to a scale starting at £2 10s. for vessels up to 500 tons register, and working up to £20 for vessels of 3500 tons to 4000 tons register; while for each additional 500 tons register above that the charge is £2 10s. The tonnage rate charges will be either in respect of the inward or outward voyage, whichever is the higher. For the purpose of calculating the dock rent, the period will be reckoned from the date of arrival in the first dock. Vessels entering only for the purpose of dry-docking will be charged a locking fee in accordance with the scale above referred to in lieu of the usual tonnage rates. The Great Western Company has gone a considerable way towards giving relief, and the concessions are greatly appreciated by the traders. These concessions have not, of course, been obtained without some sacrifice by shipowners, and in the matter of dues all ports are now brought into line. This means that there will be an increase of 3½d. per net registered ton for steamers loading at Newport for ports between Finisterre and Gibraltar, and an increase of 1½d. per ton on steamers loading at Penarth for long-distance destinations.

South Wales Ship-repairing Industry.

Reference has been made in my recent letters to the almost interminable negotiations which have been proceeding between the ship repairers and the workmen's representatives to bring about a revision of working rules so as to enable the employers to compete on fair terms with other repairing districts in this country and with the yards on the Continent. Some of the grades of workmen had agreed to the proposals of the employers, but the utmost opposition has been shown by the engineers' section to any change, with the result that progress could not be made. However, it is reported that as a consequence of a ballot the members of the Engineering Union have now fallen into line, and in the near future new working rules are expected to come into operation which should prove of advantage to all parties. No official statement is forthcoming on the matter at the moment, but doubtless it will come later.

Further Colliery Acquisition?

The report is current that the Powell Duffryn Steam Coal Company, Ltd., is negotiating to acquire the Lewis Merthyr Collieries. No official statement is obtainable, but the report is not denied.

Current Business.

The tone of the steam coal market is quiet all round, but at the same time some of the collieries are well engaged. This applies to the undertakings producing the best Admiralty large coals, which in one or two cases are fully stemmed for the next fortnight or so. Monmouthshire coals and dry qualities are not so favourably off for orders, and the demand for them is slow. Small coals keep very steady and sized coals hold their own. Patent fuel displays no appreciable improvement, while pitwood is rather easier.

CORRECTION, M.V. "SIBAJAK."—In the description of the Rotterdam Lloyd motor liner which appeared in our issue of February 17th we regret that the name of the makers of the steering gear was incorrectly stated. The four-cylinder electro-hydraulic steering gear with the telemotor controls and also the rudder steadiment were supplied by Brown Brothers and Co., Ltd., of Edinburgh.

INSTITUTION OF NAVAL ARCHITECTS.—The Council of the Institution of Naval Architects has invited Admiral of the Fleet the Right Hon. Lord Wester Wemyss, G.C.B., C.M.G., M.V.O., to succeed His Grace the Duke of Northumberland, K.G., C.B.E., M.V.O., LL.D., as President of the Institution. The election will take place at the opening of the annual general meetings at the Royal Society of Arts on March 28th next at 11 a.m.

RESERVE OF AIR FORCE OFFICERS.—The Air Ministry announces that a number of openings present themselves now to young men to be trained as pilots in the Air Force Reserve. At least sixty candidates will be accepted by the Ministry if so many of the right type are forthcoming. Applicants must be of good education and physique, but need not have had any previous flying experience. They must be over eighteen and under twenty-five years of age. Commissions are granted in the first place for five years, but at the end of that period extension may be allowed at the discretion of the Air Council for further periods each of not more than five years. Flying training is carried out at civil flying schools at Edgware and Bristol, and consists of a course not exceeding three months—preferably taken continuously—during the first six months of service; six hours' solo flying—within a maximum period of ten days' training—during the second six months; and twelve hours' solo flying—within a maximum period of twenty days' training—in each subsequent period of twelve months' service. Application forms and futher details can be obtained by applying to the Secretary (S.7.c.), Air Ministry, Adastral House, Kingsway, London, W.C. 2.

THE JUNIOR INSTITUTION OF ENGINEERS.—On Friday, February 24th, Mr. C. H. Faris gave a lecture to the Junior Institution of Engineers on the subject of "Electro-chemical Deposition of Metals." Mr. Faris said that electro-chemically deposited metal coatings were now extensively used in engineering work for effecting repairs and renovations as well as for the provision of non-corroding surfaces. The electro-chemical process with which he was especially concerned differed greatly from ordinary plating, and examination of micro-photographs and of test results clearly indicated wherein the differences lay. The metal generally used for coating purposes was nickel, and the amalgamation of the nickel with the metal on which it was deposited, whether steel, cast iron or aluminium, was very strong; in tensile tests the steel failed before the nickel-steel bond, and in the course of wear the nickel coating never lifted, even at feather edges. Nickel, being a very tough metal, provided a good surface for bearings, sleeves, axles, valve parts, and the like, although it could not compare with case-hardened steel for heavy duty work in gears, for instance. Nickel being an expensive metal, too expensive to use in the solid, it was obvious that nickel-coated steel had valuable advantages. The machining of work after deposition of nickel presented no unusual difficulties, but wherever possible grinding was resorted to. No machining was required before treatment, electrolytic cleaning processes being used. Nickel coating to prevent corrosion had been used successfully on turbine parts, condenser tubes and propeller shafts.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
Native	19/- to 21/-
(1) Spanish	19/- to 21/-
(1) N. African	19/- to 21/-
N.E. Coast—	
Native	18/- to 21/-
Foreign (c.i.f.)	21/9

PIG IRON.

	Home. £ s. d	Export. £ s. d.
(2) Scotland—		
Hematite	3 14 0	—
No. 1 Foundry	3 15 0	—
No. 3 Foundry	3 10 0	—
N.E. Coast—		
Hematite Mixed Nos.	3 10 0	3 10 0
No. 1	3 10 6	3 10 6
Cleveland—		
No. 1	3 7 6	3 7 6
Silicious Iron	3 7 6	3 7 6
No. 3 G.M.B.	3 5 0	3 5 0
No. 4 Foundry	3 4 0	3 4 0
No. 4 Forge	3 3 6	3 3 6
Mottled	3 3 0	3 3 0
White	3 3 0	3 3 0
Midlands—		
(3) Staffs.—		
All-mine (Cold Blast)	—	—
North Staffs. Forge	—	—
,, ,, Foundry	3 3 6	—
(3) Northampton—		
Foundry No. 3	3 0 0 to 3 1 0	—
Forge	2 14 0	—
(3) Derbyshire—		
No. 3 Foundry	3 4 0 to 3 4 6	—
Forge	2 19 0	—
(3) Lincolnshire—		
No. 3 Foundry	3 4 0	—
No. 4 Forge	3 2 6	—
Basin	3 2 6	—
(4) N.W. Coast— N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 2 0 (a) / 4 5 0 (b) / 4 8 6 (c)	—

MANUFACTURED IRON.

	Home. £ s. d	Export. £ s. d.
Scotland—		
Crown Bars	10 5 0	10 0 0
Best	—	—
N.E. Coast—		
Iron Rivets	11 5 0	—
Common Bars	10 5 0	—
Best Bars	10 15 0	—
Lancs.—		
Crown Bars	10 0 0	—
Second Quality Bars	9 10 0	—
Hoops	13 0 0	—
S. Yorks.—		
Crown Bars	10 10 0	—
Best Bars	11 0 0	—
Hoops	12 0 0	—
Midlands—		
Crown Bars	9 7 6 to 10 5 0	—
Marked Bars (Staffs.)	12 10 0	—
Nut and Bolt Bars	9 0 0	—
Gas Tube Strip	11 10 0	—

STEEL. (d)

	(6) Home. £ s. d	(7) Export. £ s. d.
(5) Scotland—		
Boiler Plates	10 10 0	10 10 0
Ship Plates, ½in. and up	8 7 6	7 12 6
Sections	7 17 6	7 2 6
Steel Sheets, ¼in.	8 12 6	8 15 0
Sheets (Gal. Cor. 24 B G.)	13 2 6	13 0 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	8 7 6	—
Angles	7 17 6	—
Boiler Plates	12 15 0	—
Joists	7 17 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	8 2 6	—
Soft Billets	7 2 6	—
N.W. Coast—		
Barrow—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	—
Billets	7 10 0 to 10 0 0	—
Manchester—		
Bars (Round)	8 17 6	—
,, (Small Round)	7 10 0	—
Hoops (Baling)	10 5 0	10 0 0
,, (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6	—
,, (Lancs. Boiler)	10 0 0	—
Sheffield—		
Siemens Acid Billets	10 0 0	—
Hard Basic	7 2 6 to 7 12 6	—
Intermediate Basic	7 0 0	—
Soft Basic	6 5 0	—
Hoops	9 10 0 to 10 10 0	—
Soft Wire Rods	7 15 0	—
Midlands—		
Small Rolled Bars	7 7 6 to 8 0 0	—
Billets and Sheet Bars	6 0 0 to 6 5 0	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	13 7 6	—
Angles	7 17 6	—
Joists	7 17 6	—
Tees	8 17 6	—
Bridge and Tank Plates	8 12 6	—
Boiler Plates	11 0 0	—

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	17/9 to 18/3
Block Tin (cash)	231 5 0
,, (three months)	233 17 6
Copper (cash)	60 16 3
,, (three months)	60 11 3
Spanish Lead (cash)	19 18 9
,, (three months)	20 3 9
Spelter (cash)	25 2 6
,, (three months)	25 2 6
Manchester—	
Copper, Best Selected Ingots	66 0 0
,, Electrolytic	66 15 0
,, Strong Sheets	92 0 0
,, Tubes (Basis Price), lb.	0 1 1
Brass Tubes (Basis Price), lb.	0 1 0
,, Condenser, lb.	0 1 2
Lead, English	21 5 0
,, Foreign	20 2 6
Spelter	25 5 0
Aluminium (per ton)	£107

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/7½ per lb.	
Ferro Tungsten	1/3 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£22 15 0	7/6
,, ,, 6 p.c. to 8 p.c. ,,	£22 7 6	7/-
,, ,, 8 p.c. to 10 p.c. ,,	£22 5 0	6/-
,, ,, Specially refined		
,, ,, Max. 2 p.c. carbon	£35 10 0	12/-
,, ,, ,, 1 p.c. carbon	£41 10 0	15/-
,, ,, ,, 0·70 p.c. carbon	£52 0 0	17/-
,, ,, ,, carbon free	1/1 per lb.	
Metallic Chromium	2/11 per lb.	
Ferro Manganese (per ton)	£13 10 0 for home; £13 10 0 for export	
,, Silicon, 45 p.c. to 50 p.c.	£12 17 6 scale 5/- per unit	
,, ,, 75 p.c.	£20 10 0 scale 6/- per unit	
,, Vanadium	14/3 per lb.	
,, Molybdenum	4/11 per lb.	
,, Titanium (carbon free)	0/11½ per lb.	
Nickel (per ton)	£175	
Ferro-Cobalt	9/- per lb.	

FUELS.

SCOTLAND.
(*Prices not stable.*)

	Export.
Lanarkshire—	
(f.o.b. Glasgow)—Steam	13/9
,, ,, Ell	14/6
,, ,, Splint	16/6 to 17/6
,, ,, Trebles	14/-
,, ,, Doubles	13/-
,, ,, Singles	11/3
Ayrshire—	
(f.o.b. Ports)—Steam	13/-
,, ,, Jewel	15/6
,, ,, Trebles	14/-
Fifeshire—	
(f.o.b. Methil or Burntisland)—Steam	10/9 to 12/-
Screened Navigation	18/-
Trebles	12/6
Doubles	12/-
Singles	11/3
Lothians—	
(f.o.b. Leith)—Best Steam	12/3
Secondary Steam	12/-
Trebles	12/6
Doubles	12/-
Singles	11/3

ENGLAND.

	Inland.
(8) N.W. Coast—	
Steams	24/- to 25/-
Household	37/6 to 50/-
Coke	22/6 to 23/6
Northumberland—	
Best Steams	13/6
Second Steams	11/9 to 12/-
Steam Smalls	10/-
Unscreened	11/9 to 12/-
Household	21/- to 27/-
Durham—	
Best Gas	15/3
Second	13/3 to 13/9
Household	21/- to 27/-
Foundry Coke	18/6 to 19/-
Sheffield—	Inland.
Best Hand-picked Branch	27/6 to 29/6 —
Derbyshire Best Bright House	20/6 to 21/6 —
Best House Coal	19/- to 20/6 —
Screened House Coal	16/- to 17/6 —
,, ,, Nuts	15/- to 16/- —
Yorkshire Hards	14/6 to 15/6 —
Derbyshire Hards	14/- to 15/6 —
Rough Slacks	8/6 to 9/6 —
Nutty Slacks	6/- to 7/- —
Smalls	3/- to 4/6 —
Blast-furnace Coke (Inland)	13/- at ovens —
Furnace and Foundry Coke (Export), f.o.b.	17/6 to 18/-

(9) SOUTH WALES.

Cardiff— Steam Coals :	
Best Smokeless Large	19/- to 19/6
Second Smokeless Large	18/6 to 19/-
Best Dry Large	18/3 to 18/9
Ordinary Dry Large	17/6 to 18/-
Best Black Vein Large	17/- to 17/3
Western Valley Large	16/9 to 17/-
Best Eastern Valley Large	16/9 to 17/-
Ordinary Eastern Valley Large	16/3 to 16/9
Best Steam Smal's	12/6 to 13/-
Ordinary Smalls	11/- to 12/6
Washed Nuts	18/- to 23/-
No. 3 Rhondda Large	20/- to 20/6
,, ,, Smalls	14/9 to 15/3
No. 2 ,, Large	16/- to 16/6
,, ,, Through	14/6 to 15/6
,, ,, Smalls	12/6 to 13/6
Foundry Coke (export)	30/- to 37/6
Furnace Coke (export)	27/6 to 30/-
Patent Fuel	22/6 to 24/-
Pitwood (ex ship)	27/6 to 27/9
Swansea— Anthracite Coals :	
Best Big Vein Large	30/- to 32/6
Seconds	24/6 to 27/6
Red Vein	20/6 to 25/-
Machine-made Cobbles	35/- to 40/-
Nuts	37/6 to 42/6
Beans	23/- to 27/-
Peas	17/- to 18/-
Breaker Duff	8/6 to 9/-
Rubbly Culm	9/6 to 9/9
Steam Coals :	
Large	17/6 to 18/6
Seconds	16/- to 17/-
Smalls	9/9 to 10/9
Cargo Through	15/- to 16/-

(1) Delivered. (2) Net Makers' works. (3) f.o.t. Makers' works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Delivered Glasgow. (b) Delivered Sheffield. (c) Delivered Birmingham. (d) Rebate 12/6 joists and 10/- all other materials if home consumers confine purchases solely to British products.

French Engineering Notes.

(From our Correspondent in Paris.)

The Transsaharan Railway.

THE Government has introduced a Bill into the Chamber of Deputies for the appointment of an Office des Etudes du Chemin de Fer Transsaharan. In the preamble stress is laid upon the political and military value of such a railway, but notwithstanding the many missions that have been sent out to prospect the routes there are still lacking the data necessary to judge of the practical character and probable future of the enterprise. A line of 1800 miles has to be laid across a waterless desert at a minimum cost of 3000 million francs. Its political and military character will not justify the construction unless it has an economic value, which depends more particularly upon the development of the Niger Valley, and although some reports declare that the territory watered by the Niger will, in time, become a vast cotton-growing centre, others affirm that the country to be traversed by the railway in the Niger Valley is practically barren. There is also the question of how the traffic is to be divided between the Transsaharan line and the railways from the Niger to the Atlantic coast. At present those railways are quite incapable of dealing with any large amount of traffic, and it has to be seen even whether they can deliver the material and stores necessary to allow of the Transsaharan Railway to be started upon from both ends, in which case it might be completed in about six years. Then the form of motive power has to be considered. In the absence of water, except what will necessarily have to be carried across the desert by mains, the use of steam locomotives appears to be out of the question, and employment of internal-combustion engines will have to be taken into consideration. There are many difficulties in the way of executing this vast scheme, and the Government intends to appoint on the Commission men whose technical knowledge and experience will enable them to take full account of those difficulties and to find a means of overcoming them, if they can. The amount to be devoted to this investigation is 11,500,000 francs, four millions of which will be supplied by the State, three millions each by Algeria and by the railway companies which will participate in the construction of the line, if decided upon, and the remainder by the African Colonies. The carrying out of the enterprise is regarded as only possible in the event of material being supplied by Germany under the Dawes arrangement.

Barrage Construction.

The collapse of the Perrégaux barrage in North Africa a few months ago, when it gave way to the pressure of an unusual weight of water during a flood and caused widespread disaster, was made the subject of a communication to the Académie des Sciences by M. Mesnager, the well-known authority on hydraulic constructions, who declared that solid barrages in France were too often designed with a wholly insufficient margin of safety, and constituted a perpetual danger. The trouble arose, he said, from an erroneous interpretation of the Maurice Lévy formula. The thickness at the base should be multiplied by 1·4, and that entailed a considerable addition to the cost. The danger to the public, declared M. Mesnager, was so great that a remedy must be found, and he suggested the suppression of solid barrages in favour of vaulted structures. These statements are strongly criticised by the Comité Français des Grands Barrages, which remarks that, some years ago, a Government circular abolished the use of the Maurice Lévy formula, and that the thickness at the base of solid barrages has even been reduced, without there having been a single instance of a barrage in France giving way to flood pressure. The construction of solid barrages is based, the Committee explains, upon experience in this and other countries, and it affirms that, if the thickness at the base had to be increased to the extent suggested by M. Mesnager, construction would be financially impossible.

Railway Rates.

The Conseil Supérieur des Chemins de Fer has decided to increase the railway rates on goods as a means of reducing the deficit for the present year, which is officially estimated at 1000 million francs. The increase will be 11·9 per cent., but it will be reduced to 10·8 per cent. by a diminution of the tax on transport. It is regarded as very doubtful whether this will alleviate the financial situation of the companies, for, since the war, the railway rates on goods have increased in the ratio of 1 to 6·3, and with these augmentations the ratio of increase in the tonnage transported has steadily declined. Some compensation is offered to users by specially reduced tariffs on goods consigned for export, as well as for goods delivered to the companies in sufficient bulk to make up full loads, while arrangements will be made to simplify formalities and accelerate deliveries. The idea of these concessions is to assist the export trade, especially in motor vehicles, and to reduce the time for the delivery of goods over short distances so that manufacturers and traders may find less advantage in delivering goods by motor lorries. The only hope for the companies lies in competing successfully with road traction.

The Cruising Submarine.

The launching of the "Redoutable" at Cherbourg with unusual ceremony emphasises the character of the naval policy now being carried out, aiming, as it does, at the constitution of a fleet of craft, light but sufficiently powerful to keep open the colonial routes. The "Redoutable" is the first of a new series of cruising submarines. She has a length of 95 m., a breadth of 10 m., and a displacement of 1560 tons at the surface and of 2060 tons when submerged. With two Sulzer-Diesel engines, each of 3000 horse-power, her speed will be 17·7 knots. Her radius of action is to be 8000 miles, and sufficient fuel will be carried to keep the vessel at sea for two months. She has ten torpedo tubes and will carry 32 torpedoes, while the other armament will consist of a 140 mm. gun, and anti-aircraft gun and machine guns. The new submarine will have a crew of fifty men.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

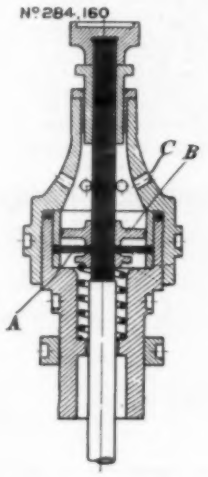
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

INTERNAL COMBUSTION ENGINES.

284,160. August 16th, 1927.—FUEL INJECTION VALVES, J. P. E. R. Christiansen, 26, Marstalsgade, Copenhagen, Denmark.

This invention relates to a tightening device, intended to replace a stuffing-box for the fuel valves in Diesel engines of the kind in which air compressors are employed and in which the valve opens inwards into the engine cylinder under the force of a mechanical pressure exerted externally on the end of the valve spindle. The characteristic feature of the invention chiefly lies in this, that instead of a stuffing-box being used as means of

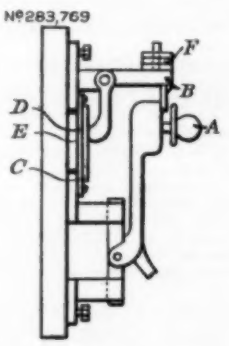


tightening for the valve spindle, a diaphragm A is used, the circumference or outermost edge of which is secured in the valve housing, and, in addition to this diaphragm, an extra or reserve tightening device is provided, consisting of an auxiliary piston B moving inside a cylindrical lining mounted in the top portion of the valve housing. The top portion of the valve housing is provided with one or more openings C, with the intention of preventing the valve housing from bursting, and also of serving to relieve the valve.—*January 26th*, 1928.

SWITCHGEAR.

283,769. April 2nd, 1927.—IMPROVEMENTS IN ELECTRIC CUT-OUTS OR CIRCUIT BREAKERS, *Conrad Arnold, of* 11 *and* 12, *Southampton-buildings, London, W.C.* 2.

A simple switch constructed in accordance with this invention is illustrated. The circuit is broken by a falling weight A, which is held in its elevated position by a detent pawl B. The other arm of this pawl bears against a chamber C, which is in contact

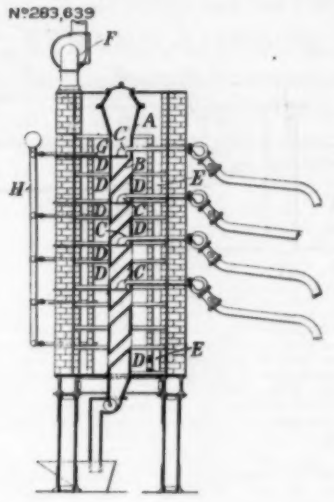


with a heating strip D. Beneath this strip there is a heat-insulating support E. The pawl can be loaded with weights F, in order to vary the setting of the circuit breaker. When a heavy overload occurs, the chamber C expands, which releases the pawl and causes the circuit breaker to open. The expansion chamber C is filled with a liquid, which vaporises with the heat produced by the strip D.—*January 19th*, 1928.

GAS PRODUCERS.

283,639. October 13th, 1926.—DISTILLATION OF SHALE OR COAL, R. H. Crozier, Finsbury-court, Finsbury-pavement, London, E.C. 2.

In the drawing A denotes a cast metal retort comprising superposed flat and semi-cylindrical sections in which the shale or coal is heated and which is provided with a series of inclined flues B traversing the retort. C are the usual vapour traps connected with exit pipes and D a series of annular flues encompassing the retort. The retort is heated externally at its upper end by a plurality of gas burners G or the like, supplied from a main H with gas produced by the distillation of the material under treatment. These burners, and particularly the burners at the highest level, serve to heat the charging end of the retort to a high temperature which sweats out and immediately volatilises the high boiling fractions which would otherwise cause great trouble in the retort. The products of combustion of these burners are carried around the flues D and down through the inclined flues B and around succeeding annular flues D to the lower end. E indicates an outer annular flue enclosing the flues D, which flue is connected at its lower end with the inner flues D and at the upper end with an uptake or the like in which is interposed a fan F. The products of combustion are drawn by the fan F downwardly around the flues D and up the outer flue E

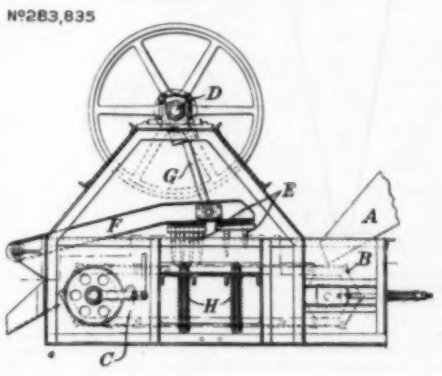


to the uptake, imparting their heat to the outer walls of the inner flues D in their passage upwards. As a result the heat of the products of combustion is utilised as fully as possible before discharge.—*January 13th*, 1928.

MINING MACHINERY.

283,835. November 9th, 1927.—COAL BREAKING MACHINES, B. Norton, Sandford Hall, Claverley, Shropshire.

This coal breaker is of the pick type, which, it is claimed, produces less dust than any other form. The coal coming from the shoot A drops on to the endless conveyor B, which is driven intermittently by the ratchet gear C from the main crank shaft

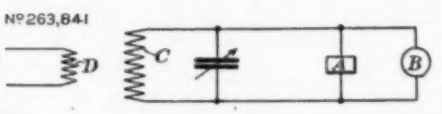


D. The picks are shown at E and are mounted on the pivoted lever F, which is worked from the main crank shaft by connecting-rods G. The movements are so timed that the conveyor remains stationary during the working stroke of the picks. The conveyor is supported by springs H which yield if the picks encounter anything they cannot break.—*January 19th*, 1928.

MISCELLANEOUS.

263,841. December 28th, 1926.—APPARATUS FOR MEASURING FREQUENCY WITH OSCILLATING ELECTRIC CRYSTALS, Radiofrequenz Gesellschaft mit beschränkter Haftung, of 5, Niedstrasse, Berlin-Friedenau, Germany.

By a luminous effect, it is possible to observe the natural mechanical oscillations of piezo-electric crystals induced by high-frequency electrical oscillations. According to this invention, an automatic limitation of the voltage amplitude conveyed to the oscillating crystal is produced by connecting a glow discharge lamp B in parallel with the crystal A. A resonance circuit C is also connected in parallel with the crystal and glow lamp, and this resonance circuit is excited by the transmitter D. If the coupling is made fairly tight, the glow lamp B



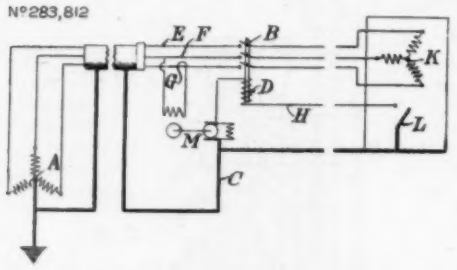
lights when the circuit C is approximately tuned to resonance. This indicates that the transmitter is working at approximately the correct frequency. If, after the glow lamp has been illuminated, the coupling between C and D is made less tight than it was originally, the frequency of D is slightly altered, and a point is reached when the crystal A commences to oscillate and to withdraw energy from the lamp B. The apparatus may be adjusted so that the lamp ceases to glow, but the oscillating crystal, which is enclosed in a gas chamber under less than normal pressure, becomes luminous. The lamp B not only acts as a protective device, but also serves as an indicator of resonance. Preferably, the lamp is combined with the luminous tube which contains the oscillating crystal.—*January 19th*, 1928.

283,812. September 6th, 1927.—IMPROVEMENTS IN OR RELATING TO SWITCH MECHANISM AND CABLE CONNECTIONS FOR ELECTRICAL MINING APPARATUS, William Rea, of 66, The Downs, Altrincham, Cheshire.

This specification describes switch mechanism and connections for electrical mining apparatus. A rotary transformer in or near the gate end box provides a low voltage and automatic switch mechanism is provided for the distant control of this direct current. The leads from the three-phase generator A run to a switch in the gate end box, in which there is a rotary

transformer M. The terminal of the generator of the rotary transformer is connected to the earth lead C, whilst the other terminal is connected to the solenoid D of the switch B. The flexible connections from the gate end box consist of three main leads E F G, the earth wire C, and the wire H belonging to the control circuit. The electrical apparatus supplied with current is shown as a three-phase motor K, with a control switch L.

N°283,812

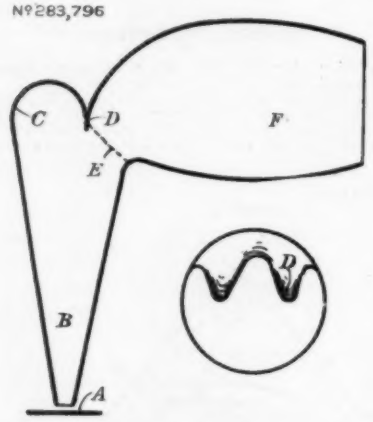


The advantages of the invention, the specification states, lie in the cheapness and greater efficiency of the apparatus, and in its greater ease of adaptability, as direct-current automatic switch mechanism is more simple than alternating-current mechanism: it requires no relays, and the only element which requires special selection for any particular power supply is the motor of the rotary transformer, which is only small.—*January 19th*, 1928.

283,796. June 24th, 1927.—IMPROVEMENTS IN OR RELATING TO SOUND AMPLIFIERS FOR SOUND-REPRODUCING APPARATUS, Richard Frenkel, of 5B, Königsallee, Berlin-Grunewald, Germany.

Many attempts have been made to produce sound amplifiers which resemble the human vocal organs, and the amplifier described in this specification is built with that object. A sound-

N°283,796

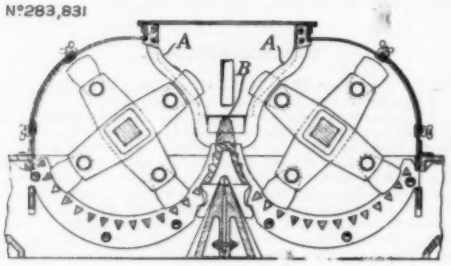


producing diaphragm A is placed at the lower end of a sound tube of the shape shown, and ending in a chamber corresponding to the pharingeal cavity. At D there is a resilient band, equivalent to the uvula. One or more uvula elements may be provided. On reaching the chamber C, the sound waves pass out through the restricted opening E and into the bell mouth F, which is equivalent to the mouth cavity.—*January 19th*, 1928.

283,831. October 28th, 1927.—IMPACT MILLS, Amme-Luther Werke Braunschweig der "Miag" Mühlenbau und Industrie A.G., Brunswick, Germany.

In this pulveriser there are two oppositely rotating beaters, the hammers of which extend radially between bars A A that form

N°283,831



the bottom of the inlet hopper. At the lower corner of this hopper there is the anvil B, against which the material to be pulverised is projected. This anvil is made in such a manner that it can be easily renewed as it wears.—*January 19th*, 1928.

284,133. June 11th, 1927.—PISTON RINGS, W. J. Banks, Brooklands, Wick-crescent, Brislington, Bristol.

This piston ring is of the compound variety, and comprises two rings A and B. A is of dovetail form, and is put in place

N°284,133

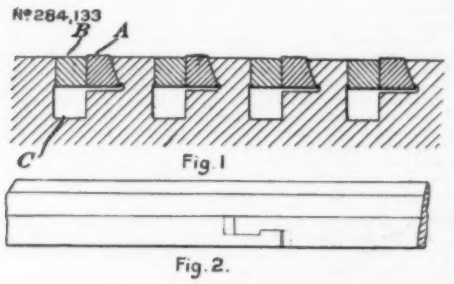


Fig. 1

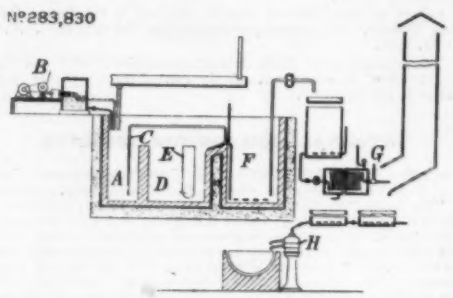
Fig. 2.

first and then the ring B is inserted. The reason for the space C below the ring B is that this ring has a bayonet joint, as shown in Fig. 2, and this space allows the joint to be closed while the ring is put in an eccentric position.—*January 26th*, 1928.

283,830. September 13th, 1926.—SEPARATING OIL FROM AQUEOUS EMULSIONS, *G. B. Ellis*, 70, *Chancery-lane, London, W.C. 2.*

This specification is most comprehensive, and while it is concerned chiefly with the recovery of oil from the wash water used to clean tin-plates, also describes the process of tinning and cleaning the plates. The wash water contains oil and zinc chloride from the tin pot and is conducted to the vat A, where it

N°283,830



is mixed with small measured quantities of sulphuric acid from the apparatus B. It is heated and agitated by steam supplied by the pipe C, overflows into the second vats D, in which it separates, so that the water goes away by the syphon E and the oil overflows into the third vat F. From this vat the mixture of oil and water is pumped, dried in the apparatus G and finally purified in the centrifuge H. It is claimed that by these means 98 per cent. of the oil used may be recovered.—*January 13th*, 1928.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

BRITISH INDUSTRIES FAIR.—Castle Bromwich, Birmingham, and at the White City, London.

FINSBURY TECHNICAL COLLEGE OLD STUDENTS' ASSOCIATION.—The Engineers' Club, Coventry-street, London, W. 1. Annual dinner.

INSTITUTION OF LOCOMOTIVE ENGINEERS.—Frascati Restaurant, Oxford-street, London, W. 1. Annual dinner. 6.30 for 7 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, London, S.W. 1. Lecture, "Some Notes on a Recent Visit to the United States of America," by Mr. A. Abbey. 7.30 p.m.

OLD CENTRALIANS.—Imperial College Union, Prince Consort-road, London, S.W. 7. Annual dinner. 7.15 for 7.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. Discourse, "The Psychology of the Sick," by Sir Farquhar Buzzard. 9 p.m.

SATURDAY, MARCH 3RD.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH.—College of Technology, Sackville-street, Manchester. Lecture, "Crystallisation in Non-ferrous Castings," by Professor C. H. Desch. 4 p.m.

MONDAY, MARCH 5TH.

BRADFORD ENGINEERING SOCIETY.—Technical College, Bradford. Lecture, "Pulverised Fuel Firing, with Special Reference to Lancashire Boilers," by Mr. W. Boon. 7.30 p.m.

INSTITUTE OF METALS: SHEFFIELD LOCAL SECTION.—Applied Science Department of the University, St. George's-square, Sheffield. "Electricity in the Service of Man," by Dr. S. Z. de Ferranti. 7.30 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS: WESTERN CENTRE.—Merchant Venturers' Technical College, Unity-street, Bristol. Paper, "Some Notes on a Practical Experience of the Single Sleeve Valve Principle," by Mr. G. L. Ensor. 6.45 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, S.W. 1. "Wave Mechanics" (I.), by Dr. E. Schrödinger. 5.15 p.m.

SOCIETY OF ENGINEERS.—Geological Society's Rooms, Burlington House, Piccadilly, London, W. 1. Paper, "The Registration of Engineers," by Mr. R. Hazleton. 5.30 p.m.

SURVEYORS' INSTITUTION.—Institution of Civil Engineers, Great George-street, London, S.W. 1. Paper, "The Estimation of Damage in Ancient Lights Disputes," by Mr. P. J. Waldram. 8 p.m.

TUESDAY, MARCH 6TH.

INSTITUTE OF METALS: NORTH-EAST COAST LOCAL SECTION.—Armstrong College, Newcastle-upon-Tyne. Annual general meeting. 7.30 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Royal Society of Arts, John-street, Adelphi, London, W.C. 2. Paper, "Automobile Steering Gear—Problems and Mechanism," by Dr. F. W. Lanchester. 7.40 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—Broadgate Café, Coventry. Coventry Graduates' meeting. Paper, "The Problem of Selling Cars," by Mr. A. E. Collins. 7.15 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS: NORTH MIDLAND CENTRE.—Hotel Metropole, Leeds. Paper, "Modern Electric Wiring, Particularly as Applied to Small Houses," by Mr. D. S. Munro. 7 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS: MIDDLESBROUGH BRANCH.—Cleveland Scientific and Technical Institution, Middlesbrough. Paper, "Lubrication," by Mr. C. H. Cooke. 7.30 p.m.

WEDNESDAY, MARCH 7TH.

INSTITUTION OF ELECTRICAL ENGINEERS.—Savoy-place, Victoria Embankment, London, W.C. 2. Wireless Section meeting. Paper, "Some Practical Applications of Quartz Resonators," by Messrs. G. W. N. Cobbold and A. E. Underdown. 6 p.m.

INSTITUTION OF HEATING AND VENTILATING ENGINEERS.—Caxton Hall, Westminster, London, S.W. 1. Lecture, "The Manufacture of Malleable Iron Pipe Fittings," by Mr. H. R. Hiscott. 7 p.m.

INSTITUTION OF SANITARY ENGINEERS.—Denison House, 296, Vauxhall Bridge-road, London, S.W. 1. Paper, "Tidal Rivers and Floods," by Mr. W. Lionel Jenkins. 6.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. "Wave Mechanics" (II.), by Dr. E. Schrödinger. 5.15 p.m.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, London, W.C. 2. Trueman Wood Lecture, "Some Wider Problems of Cosmogony," by Dr. J. H. Jeans. 8.30 p.m.

WEDNESDAY AND THURSDAY, MARCH 7TH AND 8TH.

INSTITUTE OF METALS.—Institution of Mechanical Engineers, Storey's-gate, London, S.W. 1. Annual general meeting. For programme see page 156. 10 a.m. each day.

THURSDAY, MARCH 8TH.

OPTICAL SOCIETY.—Imperial College of Science, South Kensington, London, S.W. 7. Annual general meeting. Presidential address, "The Stereoscope," by Dr. R. S. Clay. 7.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. "Optics and Chemistry," by Dr. J. J Fox. 5.15 p.m.

FRIDAY, MARCH 9TH.

INSTITUTION OF CIVIL ENGINEERS: BIRMINGHAM DISTRICT ASSOCIATION; INSTITUTION OF MECHANICAL ENGINEERS: MIDLAND BRANCH; INSTITUTION OF ELECTRICAL ENGINEERS: SOUTH MIDLAND CENTRE.—Chamber of Commerce, New-street, Birmingham. Annual joint meeting. Lecture, "Engineering Works in India," by Mr. F. Palmer. 6.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, London, S.W. 1. Lecturette, "Air Compressors," by Mr. E. S. Huntingford. 7.30 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—Mining Institute, Newcastle-upon-Tyne. Paper, "Measurement of Power," by Mr. J. S. Brown. 6 p.m.

PHYSICAL SOCIETY.—Imperial College of Science and Technology, South Kensington, London, S.W. 7. Thirteenth Guthrie Lecture, "Electrodeless Discharge Through Gases," by Sir Joseph Thomson. 5 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. Discourse, "The Sun's Outer Atmosphere," by Mr. E. A. Milne. 9 p.m.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, London, W.C. 2. Indian Section meeting. "The Air Routes of India," by Lieut.-Col. A. E. Edwards. 4.30 p.m.

SATURDAY, MARCH 10TH.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. "The Transformation of Matter," by Sir Ernest Rutherford. 3 p.m.

TUESDAY, MARCH 13TH.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH, BURNLEY SECTION.—Municipal College, Ormerod-road, Burnley. Paper, "Foundry Conditions," by Mr. W. H. Meadowcroft. 7.15 p.m.

WEDNESDAY, MARCH 14TH.

INSTITUTION OF ENGINEERS-IN-CHARGE.—St. Bride Institute, Bride-lane, Fleet-street, London, E.C. 4. Paper, "Wells and Well Boring," by Mr. G. A. Hughes. 7.30 p.m.

OVERHEAD LINES ASSOCIATION.—Institution of Electrical Engineers, Savoy-place, Victoria Embankment, London, W.C. 2. "Joint Use of Wood Pole Lines for Electricity Supply and Communication Systems," by Mr. E. S. Byng. 5.30 p.m.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, London, W.C. 2. "The Lead Acid Cell: Its Place in Modern Industry," by Mr. H. G. Brown. 8 p.m.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

MR. H. SCOTT-DENNINGTON, of 14, Waterloo-place, Lower Regent-street, London, S.W. 1, asks to us announce that he has severed his connection with Kryn and Lahy Metal Works, Ltd., of which he was formerly chairman and managing director.

THOSE of our readers who belong to the Institution of Electrical Engineers, as well as his numerous friends, will, we are certain, be glad to hear that Mr. P. F. Rowell, the Secretary of that body, who has been ill for some time, continues to make good progress towards recovery.

WATTS, FINCHAM AND CO., Ltd., of 22, Billiter-street, London, E.C. 3, ask us to state that, although their "Wefco" Works, Southfield-road, Acton, W. 4, have been destroyed by fire, they are arranging for temporary accommodation during rebuilding, and that all orders will be completed. The destruction of their engineering works in no way affects their ships and engineers' stores and shipping business, which are carried on at the head office in Billiter-street and at the warehouses, 39-40, Willow Walk, Bermondsey, S.E. 1.

CONTRACTS.

EDWARD BENNIS AND CO., Ltd., have received orders for a total of eighteen chain-grate stokers of various sizes for the power stations of the following:—City of Sheffield, Ashton-under-Lyne, City of Wakefield, City of London (Bankside), Bury, and Kingston, Isle of Wight.

SIR W. G. ARMSTRONG, WHITWORTH AND CO., Ltd., announce that they have received from the Great Western Railway Company an order for the supply of fifty 0-6-2 type superheater tank locomotives The same firm has received from the Southern Railway Company an order for the construction of fourteen six-wheeled tenders.

THE BRITISH THOMSON-HOUSTON COMPANY, Ltd., of Rugby, informs us that the Leeds Corporation Electricity Committee has recommended the City Council to accept its tender for the two double-cylinder 25,000-kW, 3000 r.p.m., turbo-alternators, required for the new power station which is to be erected at Kirkstall. The turbo-alternators are rated at 35,714 kVA, 10,500/11,500 volts, three-phase, 50 cycles, and the turbines are designed for a working steam pressure of 450 lb. per square inch gauge at 750 deg. Fah. temperature. The total value of the contract, which was secured in the face of very strong continental competition, is £176,504. The same company has also received an order from the Southern Railway for a six months' supply of "Mazda" electric lamps.

BEYER, PEACOCK AND CO., Ltd., have received from the London and North-Eastern Railway an order for ten 4-6-0 tender locomotives, of the Great Eastern Section type. These locomotives, which have inside cylinders, are to be fitted with Lentz poppet valves. The same company has also received an order from the India Stores Department for sixty boilers for express passenger and freight locomotives, to be fitted with superheaters, and intended for the conversion of existing engines, and from the Crown Agents for the Colonies an order for two "Garratt" 2ft. 6in. gauge locomotives for the Sierra Leone Government Railways. These engines are to be capable of developing 15,000 lb. tractive effort at 75 per cent. on a maximum axle load of 5 tons. The wheel arrangement is 2-6-2, 2-6-2.